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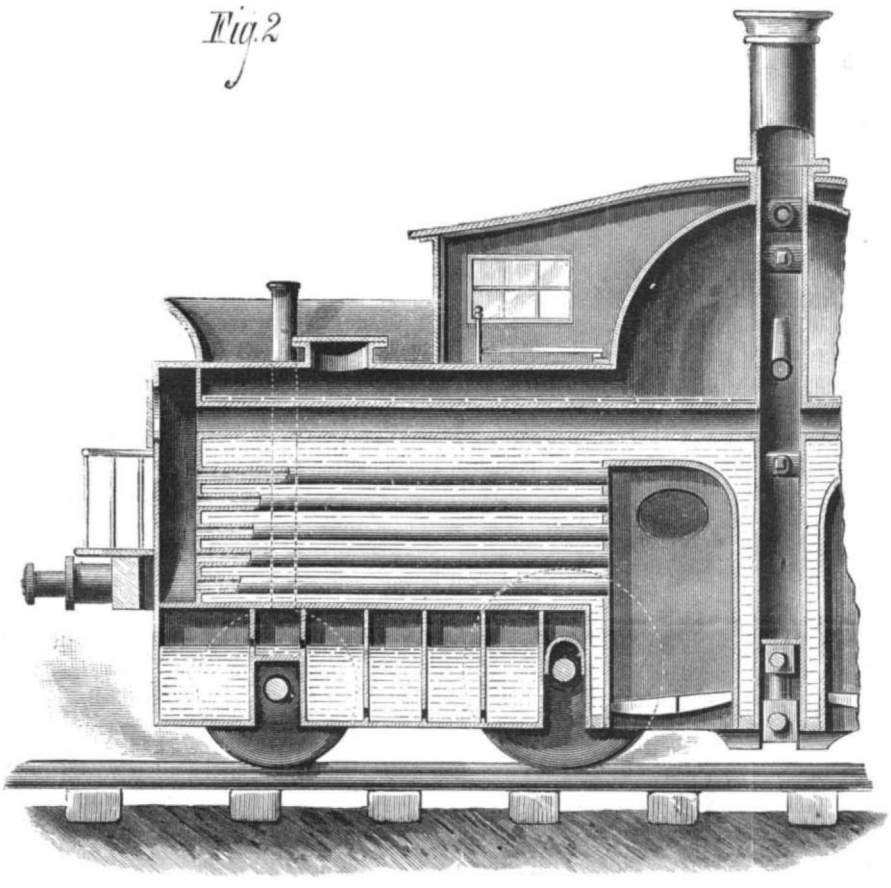
THE RAUB CENTRAL POWER LOCOMOTIVE.

We present illustrations of a new system of constructing railroad locomotives, recently patented by the inventor, Doctor Christian Raub, of New York city. The object of this invention is to construct a perfectly balanced locomotive, in which the center of gravity is coincident with the vertical median line of the engine, and in which the motive power is located at the middle of the engine in a plane extending through the center of gravity. These two objects being attained, it is hardly possible to overestimate the value of the invention, since the locomotive will then be constructed upon correct principles and according to natural laws. It works from its center, and has its motive power situated in a plane extending through its center of gravity, and has therefore no dead weight.

It is not within the scope of this article to review the various attempts and experiments undertaken in the course of time in this direction, but it may be stated generally that the problem of locating the center of gravity in a railroad locomotive upon the center of its base formed by the driving wheels, and to place the motive power at that center, had not been solved before the invention of Dr. Raub; and probably the reason why these attempts have not been successful is, that the fact was not sufficiently realized that Stephenson's system was at variance with the principles above referred to, and that nothing short of a radical change of

[*Continued on page* 245.]

Fig. 2



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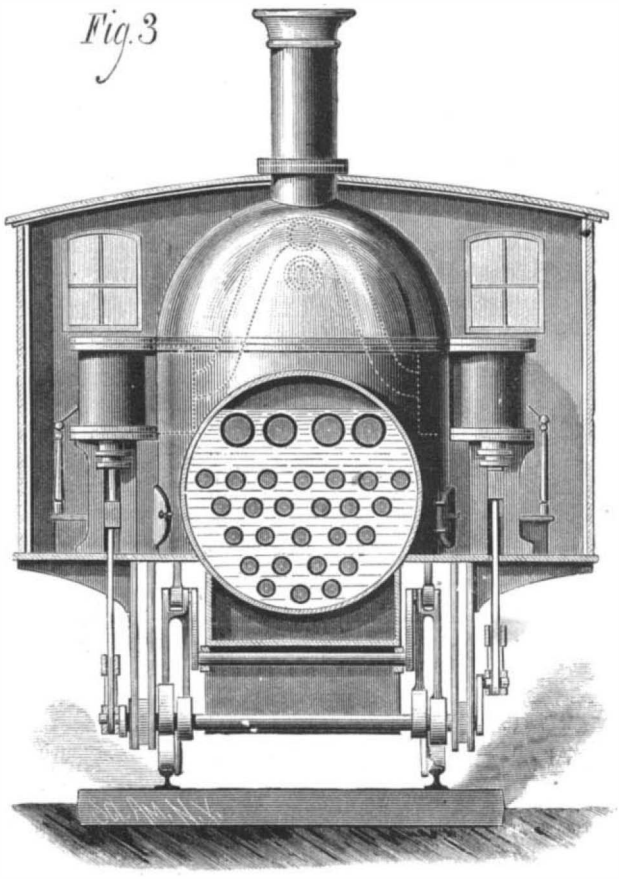

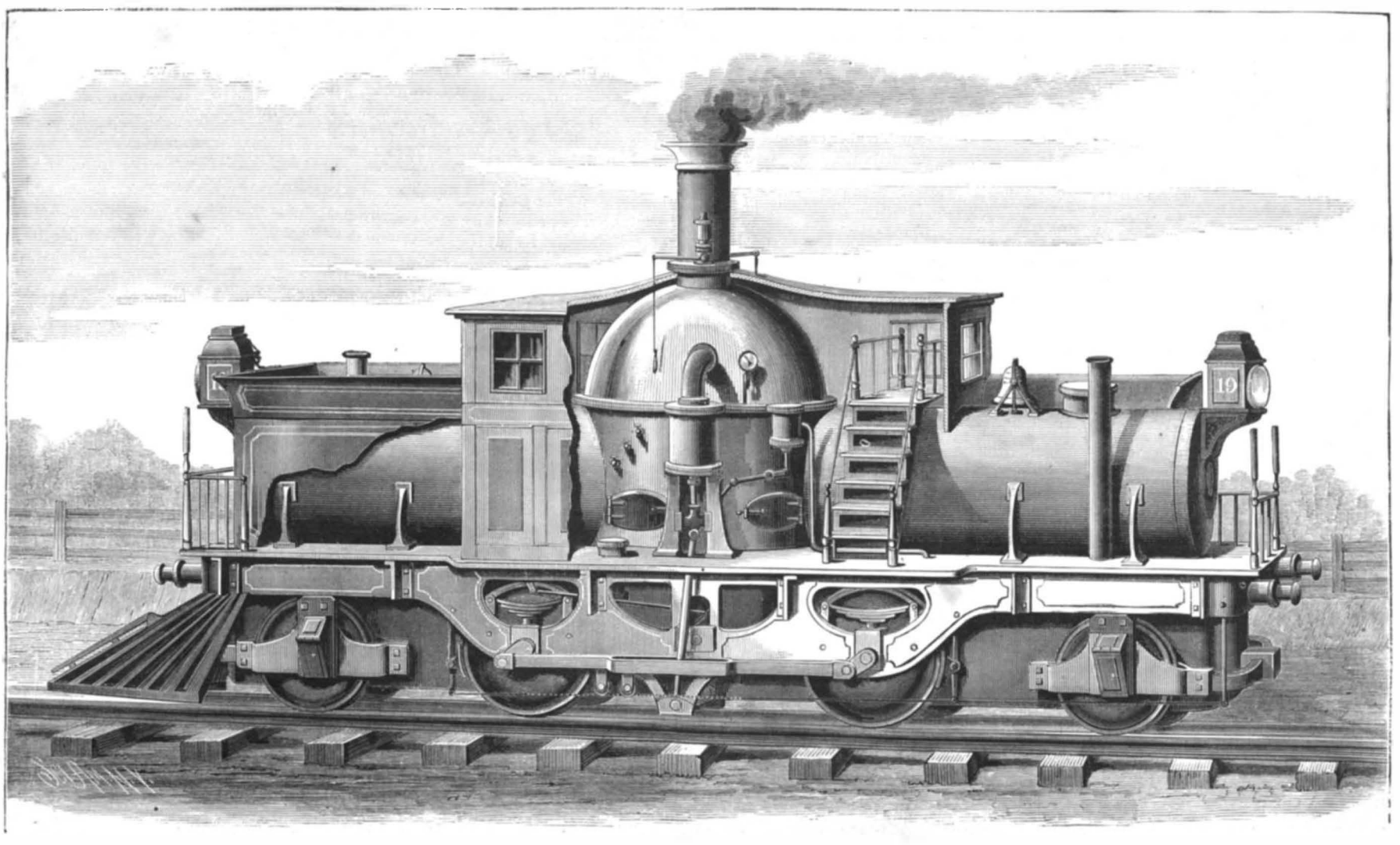

THE RAUB CENTRAL POWER LOCOMOTIVE.

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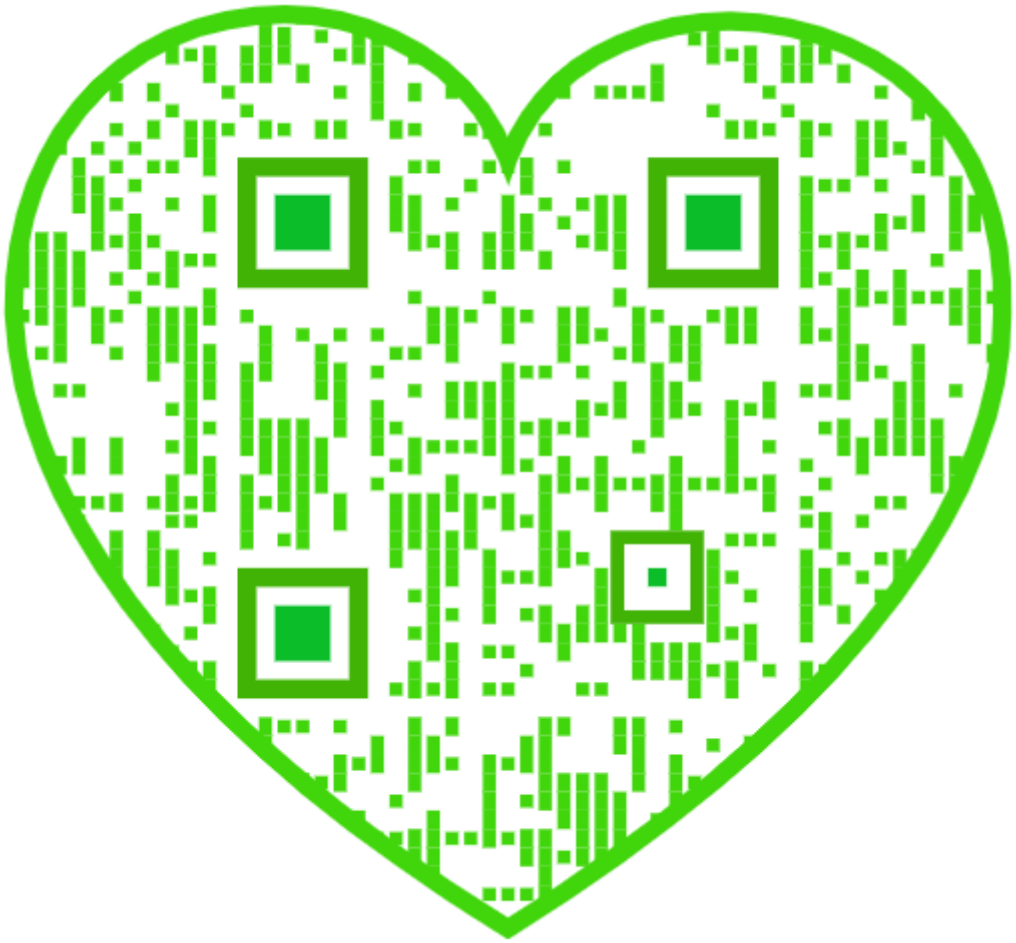

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NEW YORK, SATURDAY, OCTOBER 15, 1881.

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A FIELD FOR INVENTION.

With the utilization of every new natural product there is required a more or less extensive group of new machines and implements. It is not surprising, therefore, that with the increasing attention paid to the American agave as a fiber plant there should come a demand for new implements and appliances to be used in securing and cleaning the fiber.

The plant (*Agave americana*) is described as a member of the amaryllis family. It is put to a great variety of uses by the natives of Southern Mexico and Yucatan. A gentleman commercially interested in the development of this plant says that a coarse thread has long been made of the fiber. The disagreeable gummy substance which forms the bulk of the thick leaves has peculiar saponaceous properties, which has caused the agave to be known sometimes as the soap plant. When the leaf is split longitudinally the surface of the hollow center is found to be so thickly covered with fine particles of silica that it makes an excellent hone for sharpening knives, razors, and other edged tools. There are quite a number of varieties of the agave. In arid soils and on the uplands its leaves, in a cluster around a stalk which reaches but a few inches above the ground, are often not more than a foot or two feet long, very thick, and six to eight inches broad at the base. Other varieties are known as Bromelia, Henequin, silk grass, Ixtle. On the lowlands, especially in Yucatan, Honduras, and Nicaragua, where the pita grows most luxuriantly, the leaves are narrow and thin, containing a smaller amount of gum and sap, and are sometimes sixteen feet long, the average length being ten feet. The leaves continue green and increase in length during nearly the entire life of the plant, which varies from ten to seventy years. When the plant approaches maturity a flower stalk shoots up from the center of the leaf cluster to a height of about thirty feet. The plant then flowers and dies. Experiments have shown that the fiber of the finest varieties is so finely divisible that it can be advantageously woven with silk. It bleaches without loss of strength, and takes dyes as perfectly as any fiber known. It has also been successfully woven with cotton and wool. The uses to which the natives have put the fiber are the manufacture of bowstrings, nets, ropes, mats, sacking, fish-lines, hammocks, and a few coarse garments. They obtain the fiber by the very primitive method of gathering the leaves and pounding it out between stones and "whipping" it to cleanse it. Yet prepared in this rough way the product possesses a strength and durability much greater than manila hemp. When combed out with a comb or hackles it has been pronounced equal to the best Russian flax. From the different varieties of this plant fibers of all the different grades can be obtained from Mexico and Central America sufficient to supply the whole world. Exports from Yucatan to Europe have been found very profitable, although the quantity exported is yet small. An American company has recently established a mill with machinery for preparing the fiber not far from Vera Cruz, but the yellow fever which has prevailed at that port has prevented the company from securing the necessary labor and work has been unnecessarily delayed.

Another company has been formed for the development of this and other fiber plants in Honduras, having secured for this purpose a vast tract of country on the Caribbean coast. The Panama *Star and Herald* of recent date says:

"A sample of 'pita' (*Bromelia febrista*) was lately sent from Belize to New Orleans. Experiments prove it to possess an exceeding strong and valuable fiber. The sample, which was of a yellowish tint, was bleached by the Roberts Kendal process to a snowy whiteness, and now presents the appearance of fine and delicate white silk. As this valuable fiber can now be extracted from its pulpy covering and bleached perfectly white without loss of material, and at the same time very expeditiously, it bids fair to become an important article of commerce between the Central American States and the United States. The production of this staple is unlimited in Central America, and its cultivation should be largely encouraged."

Special efforts are being made to substitute the cultivation of this plant in the French island of Mauritius, in place of sugar and other crops which have failed. A planter appeals to the Paris correspondent of the *World* to set the problem of inventing a machine for preparing the fiber before our "clever American inventors." He says: "The man who does that will not only powerfully contribute to the prosperity of our little island, but—which is far better to a practical mind—he will at the same time most certainly make his own fortune."

The pita or agave fiber brings in London an average price of $150 a ton.

THE MORAL INFLUENCE OF THE TELEGRAPH.

"One touch of nature makes the whole world kin."

Men have accepted this saying in a broader sense than Shakespeare dreamed. But for a world-wide manifestation of its truth, for a signal demonstration of the kinship of humanity, men have had to wait until science and invention had brought all nations into something like instant communication. It was the touch of the telegraph key, a favorable opportunity being presented, that welded human sympathy and made possible its manifestation in a common, universal, simultaneous heart throb.

We have just seen the civilized world gathered as one family around a common sick bed, hope and fear alternately fluctuating in unison the world over as hopeful or alarming bulletins passed with electric pulsations over the continents and under the seas. And at last, on the same day, the nations stand in sympathethic mourning: a spectacle unparalled in history; a spectacle impossible on so grand a scale before, and indicative of a day when science shall have so blended, interwoven, and unified human thoughts and interests that the feeling of universal kinship shall be, not a spasmodic outburst of occasional emotion, but constant and controlling, the usual, everyday, abiding feeling of all men toward all men.

THE LESSON OF MR. GARFIELD'S YOUTH.

Nothing that Mr. Garfield ever did will mark so grand an issue, or contribute so much to emphasize the new era upon which humanity has entered, as his dying. It was everything that he did and attempted in life, however, and especially the manner of his doing and attempting, that made it possible for his death to be one of the notable deaths of history.

After all, there is nothing that the world esteems so highly as broad, forceful, generous, genuine manliness; and it was because Mr. Garfield had acquitted himself nobly as a man in his long and arduous struggle with life and death that the best men and women of all nations lamented the untimely ending of his career. It is true that the exigencies of political life had resulted in his achievement of one of the most conspicuous and honorable positions among men; but neither that nor the atrocity of the crime which cost him his life could alone have awakened such national and international sympathy and interest as we have just witnessed. It was the manliness of the man, not the dignity of his station, that the world regarded.

It is a question for the rising generation to consider: How and under what influences the manliness of Mr. Garfield was developed and demonstrated.

Nature's first and best gift to man he had at birth—a strong body, well set up, and endowed with vigorous and healthy instincts. Thus, in the highest sense, he was well born. Beyond this his early prospects were certainly not brilliant. His early home was a rude, single-roomed log house in the wilderness. Orphaned in his second year by the death of his father, the poverty he was born to was intensified and saddened by the lack of a father's care and guidance. For fourteen years the log house was his home, and hard work his chief educator. The family circumstances improved slowly, and the older boys built for their mother a small frame house with three rooms on the ground and two under the roof. Here was young Garfield's home for two or three years more, during which he earned something at odd jobs among the neighboring farmers.

At this time his ambition was to be a sailor on the lake. His ambition was not gratified, and he hired himself to a cousin at ten dollars a month to drive the horses of a canal boat. He was now seventeen years old, an age at which most boys regard their education complete or hopeless of attainment. His, so far as books went, had not begun.

At eighteen a fit of sickness kept him in bed for months. To divert him from his intention to be a sailor his mother persuaded him to begin to prepare himself to be a country school teacher. Then, if he still desired to, he could sail summers and teach winters, and so be earning something all the time. He had no money, but by working with a carpenter at odd hours and Saturdays he earned enough to buy books and pay his board. In the winter he taught a district school. At twenty he pluckily decided to prepare for college, counting that he could work his way through in ten or twelve years.

At the age of twenty-three he was ready to go to college, and had saved enough money while teaching to pay his way for the first year. By borrowing money on a policy of insurance on his life he was able to complete the rest of his college course without the anticipated delays, graduating at the age of twenty five. For the next five years he taught, reading law meantime, and then entered upon political life in the Ohio Legislature. In 1861 he was admitted to the bar, and in the winter of the same year, in response to the call for volunteers, he abandoned his legal plans and entered the army.

By this time he had developed those traits of character and a capacity for painstaking effort and hard work which made his promotion comparatively rapid. In 1863, at the age of thirty-two, he resigned a major-general's commission for a seat in the U. S. House of Representatives upon the urgent solicitations of President Lincoln. After seventeen years of diligent service in the House he was chosen to represent his State in the Senate, but before taking his seat he was elected President of the United States.

It is impossible here to touch upon those details of character and circumstance which fittingly illustrate the nature, severity, and grand success of the struggle upward to be seen in the life we have so baldly outlined. The lessons to be learned from such a life cannot be too strongly commended to the young, whether born to poverty or wealth.

The early life of poverty and hard work which young Garfield inherited undoubtedly developed much of the force and manliness which he displayed in after life, and saved him from many of the hinderances and temptations incident to inherited riches and social position; but it must not be forgotten that the vigorous body and passionate nature, which he disciplined and made the basis of a pure and lovable manhood, carried and involved moral hazards not less than those of wealth.

He overcame the disadvantages of early surroundings, as thousands of other young men have, simply because he

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willed to and was willing to pay the price of personal and social advancement in hard and patient effort, integrity of purpose, and a readiness to do his best in everything that might fall to him to do. He made opportunities to work where he found none open, and when responsibilities were laid upon him by his townsmen or countrymen he met them bravely and studied hard to fit himself for the duties to be performed. Above all, he sought to prove himself in all things worthy of his own self-respect. There was one man, he said, whose good opinion he desired before all others, for that man he had to eat with, and work with, and sleep with; his name was James Garfield.

There is not a young mechanic who reads these lines, however humble his position, however scanty his opportunities, who cannot rise in position, knowledge, and personal worth by the same means. He may not gain great learning, great wealth, or fame by the effort, but he cannot fail to gain what is worth more than all these in themselves—a higher, truer, and more enjoyable manhood.

The failures of some men are grander than the successes of others. And while Mr. Garfield's life, tried even by conventional standards, was a splendid success in the end, it should not be forgotten that during most of his life sudden death would have found him in the ranks of the worthily inconspicuous, with those "who failed on earth great men to be, though better than the men who wore the crown."

It was a sincere, purposeful, kindly, and laborious life that made it possible for the close of his life to be signally conspicuous and his memory revered. Any youth who will can accomplish the life, though kind Fortune may spare him the pain and the glory of so tragic a termination of it.

THE HOLY WELL AT MECCA.

When Mohammed captured Mecca, which had been regarded for ages by his countrymen as a place of peculiar sanctity, he interfered with the worship of the Black Stone (probably a meteorite) which the angels had brought from heaven, and of the Zemzem, or Holy Well of Hagar, only so far as to suppress the ancient polytheistic rites. This well is close beside the Caaba or Square House, the chief sanctuary of the Mohammedan world.

The princes of Islam maintain at Mecca keepers of the Holy Well, who annually supply them with water to be used on great occasions and in great emergencies, as when stricken with disease. Every pilgrim to Mecca—and thousands come thither from all countries—visits the well and is purified by drinking the water or pouring it over his person, or both. The water is described as unpleasant in taste and cathartic in effect—qualities which are now to be accounted for without recourse to miracle.

With Occidental irreverence the British Consul-General at Jeddah has sent a bottle of the water to the Royal College of Chemistry at South Kensington to be analyzed. Dr. E. Frankland, in his report of the analysis, says that the water is of the most abominable character. "In fact, it is sewage more than seven times as concentrated as London sewage, and it contains no less than 579 grains of solid matters per gallon. Knowing the composition of this water, and the mode of propagation of Asiatic cholera by excrementitious matters, it is not to be wondered at that outbreaks of this disease should often occur among pilgrims to Mecca, while it would scarcely be possible to provide a more effective means for the distribution of cholera poison throughout Mohammedan countries."

It would be interesting to know the composition of the waters of other holy wells of which Islam has by no means the monopoly.

STEAM BOILER NOTES.

A foreign correspondent wishes to know why locomotive boilers work satisfactorily with so much less steam room per horse power than is usually found in marine boilers. He cites good English practice to show that fully three-fourths of a cubic foot of steam room is allowed per indicated horse power in marine boilers, while only one-eighth to one-twelfth of a cubic foot is allowed in locomotive boilers, and asks, To what shall the steam room be proportioned, if not to the indicated horse power? The answer to the first part of the inquiry is, the greater pressure relatively to the power developed in the locomotive. But the subject does not seem to admit of such categorical treatment as our correspondent seems to indicate by the tone of the query. Perhaps an empirical rule might be made from a sufficient number of experiments, embracing most of the conditions of modern practice, but the factors of the problem include everything that affects the rate of evaporation and the free escape of the steam from the surface of the boiler water and the steam pressure.

The efficiency of the heating surfaces, the ratio of grate to heating surface, the rate of combustion, the circulation of the water, the quantity of water and its depth upon a unit of heating surface, the surface area from which the steam escapes into the steam space, the pressure upon that surface relatively to the power developed by the engine; and inasmuch as the number and volume of the cylinder charges for cut-off engines are determined, in some degree, by the grade of expansion for a given power, the point of cutting off enters with the other numerous factors into the problem.

An illustration in point is of a small winding engine the boiler for which was, for special reasons, made small and upright, and intended to work at about one hundred and fifty pounds of steam, but it was thought best to test the machinery at a lower pressure than the design contemplated; so, in order to get full speed, it was adjusted to work steam nearly full stroke of the piston. The foaming and priming of the water was, however, so bad as to prevent the use of the engines under these conditions; but at the higher pressure, and with a correspondingly high grade of expansion, there was no further trouble from foaming. It will probably occur to the inquirer that locomotives are worked at all grades of expansion and at considerable variations of pressure, but a little thought will lead to a correct appreciation of the difference in causes that produce priming in different types of boilers.

As a general proposition, it may be said that, other things being equal, high-pressure boilers require less steam room per unit of power than low-pressure ones.

The explosion of the boiler in Card & Co.'s sawmill, near Monroe, Jasper County, Iowa, resulted in the instant death of E. N. Garnant and the fatal injury of M. L. Card, on the 17th of September.

The locomotive of a freight train between Chetopa, Kansas, and Parsons, on the Missouri Pacific road, exploded September 21, wrecking the engine and a dozen cars, killing Geo. Adams, engineer; Simon Bailey, fireman; John Denny, and a man named O'Neil. One of the victims was blown two hundred yards and terribly mangled. Bailey's head was blown off and could not be found.

A boiler explosion occurred at the mines of the Dunbar Furnace Company, Dunbar, Fayette county, Pa., on the 16th of September. James McDonald, fireman, was fatally, and George McAnally dangerously injured, and several others were slightly hurt.

The boiler of a thrashing machine exploded at Thurlow, Ont., Friday night, September 23, killing Andrew Lloyd, Messrs. Malcolm and Anson, and Miss Caldwell, and seriously injuring three others.

The method of feeding water to steam boilers has fully kept pace with other improvements in steam engineering. The plan of serving cold water to locomotive boilers, which prevailed only a few years ago, is now a thing of the past, greatly to the advantage of the boilers. The injector in its early days was not understood, was not reliable, and it was therefore shunned by careful engineers as a boiler feeder. The difficulty has now been fully met and overcome by the Korting Double Tube Injectors, which are shown in full lines at the American Institute Exhibition. They are made to work at all pressures, and to *lift* hot or cold water and deliver it at the rate of from 80 to 4,000 gallons per hour. They are compact, self contained, and easily set up by any steam fitter, and they will start readily, operated by a single handle, without any adjustment for variations in steam pressure. The boilers of the Institute are being fed with one of them, which any one, no matter how inexperienced, can learn to put in motion and regulate while "you wait."

These fine goods, with a line of Straightway check valves are shown by A. Aller, of 109 Liberty street, New York.

Exhibition of Smoke-preventing Apparatus.

The Department of State at Washington is in receipt of a communication from the British Legation, relative to the exhibition to be held in London of apparatus of all kinds devised to prevent smoke and to consume smokeless as well as other kinds of fuel. The exhibition will be open from October 24 to 26 inclusive, and the Department has been further informed by the British Charge d'Affairs at Washington that the committee has decided to consider favorably all applications from foreign exhibitors throughout the whole of September, and they will, as far as possible, reserve space for late exhibits, so that none may be excluded.

American Awards at the Geographical Exhibition in Venice.

The following awards were made to the American Section of the Geographical Congress:

Group First.—A letter of distinction to the engineering department for topographic and hydrographic surveys of the Northern lakes, the St. Lawrence and Mississippi river internal improvements, maps of battle fields, and other geographical works; also a letter of distinction for the geographical surveys in charge of Captain Wheeler for accuracy in topographical surveys west of the one hundredth meridian.

Group Second.—A letter of distinction for the best model of the Gulf of Mexico and for the sea soundings of Commander Sigsby and other officers of the navy; also a letter of distinction for the report of Commander Green on international longitudes, hydrographical charts, American ephemerides, a publication on the solar eclipse of 1878, and other papers by naval observers; a diploma of honor of the first class for a list of lighthouses, bound sets of charts, and other publications; a letter of distinction to the engineers of the Department of Geological Natural History and for the examination for Clarence King's exploration along the fortieth parallel; also a letter of distinction for Captain Wheeler's geographical surveys and works on natural history west of the Mississippi; a similar letter to the Signal Service Department and Weather Bureau for an extended series of tidal weather maps.

Group Sixth.—A letter of distinction to the Post Office Department for a series of announcements and other publications; a diploma of honor of the second class to the Agricultural Commission, and for reports on forestry by Professor Hough; honorable mention is made of the statistics of the Treasury Department for their quarterly and other reports.

Group Eighth.—A letter of distinction to the Engineer Department for Captain Wesscher's exploration and survey west of the Mississippi.

ELECTRO-METALLURGY.

ELECTROTYPY.

In taking impressions or moulds of *under-cut* or highly-wrought work it is necessary to use a flexible substance to admit of separating the mould and model without injury to either. For these purposes gelatine—or gelatine and glue or sirup—and gutta percha are employed. Glue (of the finest quality) or gelatin is softened by soaking over night in cold water, then removed from the water and dissolved by aid of heat in a quantity of pure glycerine equal to the dry glue taken. This mixture is kept over the water bath for several hours, and is then ready to pour over the warm, well-oiled model. After standing for several hours, or until thoroughly cooled, it may be removed from the model by careful manipulation. When removed it is dipped repeatedly in a solution of one ounce chromic acid in a quart of water, each time being exposed to strong sunlight (every part), which renders the surface waterproof and non-absorbent. When dry the surface may be metallized, and a strong current with a large anode used at first in the bath. With such work much care is necessary to exclude air bubbles from the deep-wrought portions.

In using gutta percha the moulding operation is conducted either by press, by hand, or in a stove.

By hand.—After purification in boiling water, plates of various thicknesses or lumps are formed.

A quantity sufficient for the intended mould is cut and put into cold water, which is gradually heated until the gutta percha is soft enough to be kneaded like dough. After having pulled the gutta percha in every direction the edges are turned in so as to form a kind of half ball, the smooth convex side is applied to the middle of the model, then it is spread over and forced to penetrate the details of the object. The kneading is continued as long as the material remains sufficiently soft, when it is allowed to cool somewhat. While at a temperature of about 80° Fah. it is separated from the model and dipped into cold water to harden, and may then be handled without danger of impairing its accuracy.

With some models it is preferable to heat the gutta percha in a copper dish with constant stirring until it becomes a semi-fluid paste. This is poured over the pattern previously placed in an iron ring. After a few minutes it may be kneaded in with wet or oiled fingers until it scarcely yields to pressure. In removing the mould from the pattern all useless parts, especially those which have passed under the pattern and bind it, must be first removed. Then the proper position and shape of the covered pattern must be ascertained so as not to break the model or tear the gutta percha.

For moulding by sinking or kneading the following composition is preferable to pure gutta percha: Gutta percha, 2 parts; linseed oil, 1 part. Heat the oil in a copper vessel to about 212° Fah., then gradually stir in the gutta percha cut fine. When the whole is in a pasty form and begins to swell up with the production of thick fumes, throw the contents of the kettle into a large volume of cold water, where, without loss of time, the paste must be kneaded, and, while still hot, rolled upon a slab of marble and passed between mediumly warm rollers.

Gutta percha may be used an indefinite length of time.

In moulding by press.—After the object has been coated with plumbago or tallow it is put square and firm upon the table of a screw press, and surrounded with a frame or ring of iron a little higher than the most raised portions of the model. A piece of gutta percha at least the thickness of the pattern is cut so as to fit the ring or frame of iron, and then heated on one of its faces only before a bright fire. When about two-thirds of its thickness has been softened it is placed, soft portion downward, in the iron ring or frame, and the whole covered with a block of metal exactly fitting. It is put under light pressure at first, the force being increased as the gutta percha becomes harder or more resisting.

Stone moulding is resorted to with models the brittleness of which renders them liable to injury when pressure is applied—plaster of Paris, alabaster, marble, etc. The object is placed upon a plate of iron or earthenware, a ball of gutta percha is placed on the middle of the object, and the whole is set in an oven where the temperature is just sufficient to melt the gutta percha, which, as it softens, penetrates all the details; when it has sunk completely it is removed from the oven and allowed to cool off until it retains just enough elasticity to be separated from the pattern.

Gutta percha is entirely insoluble in water, weak acids, or acid salts. When moulded it is prepared for the deposition of metal by being coated with a film of graphite or bronze powder.

Grass Fired by a Meteorite.

A fire ball was seen to fall at Springfield, Ill., about 10 o'clock of the night of September 21. It resembled in appearance an electric light, and it fell with a rushing sound like that of a sky rocket. The dry grass was set on fire where it struck, and the grass burned to a wooden sidewalk connecting with fences and wooden buildings, before the fire could be extinguished with water.

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Vegetable Blacking.

The "Shoeblack Plant" is said to be the name popularly given to a species of Hibiscus growing in New South Wales, and remarkable for the showy appearance of its scarlet flowers. Growing freely in almost any kind of soil, the plant is frequently cultivated for the flowers, which, when dry, are used as a substitute for blacking. The flowers contain a large proportion of mucilaginous juice, which, when evenly applied, gives a glossy, varnish-like appearance, which is said perfectly to replace ordinary blacking, with the advantage that it is cleanly in use and can be applied in a few moments. Four or five flowers, with the anthers and pollen removed, are required for each boot, and a polishing brush may be applied afterward, if desired. A few plants of the *Hibiscus rosa sinensis* growing in the garden would remove one of the minor disadvantages of a day in the country, where the roads are dusty and Lee and Bixby are almost unknown. Chinese ladies use the juice of the flowers for dyeing their hair and eyebrows. In Java the flowers are really used for blacking shoes. The plant is a native of India, China, and other parts of Asia. It would be interesting to ascertain to what extent, if any, the Althea, or Hibiscus Syriaca, and the Swamp Rose Mallow, another member of the Hibiscus family, possess the same property.

NEW CLOTH-CUTTING MACHINE.

The enormous quantities of ready-made clothing annually produced in this country has created a demand for some more expeditious plan of cutting out garments than the usual way of cutting them by hand. Several kinds of cutting machines have been manufactured to meet this expressed want. None of these machines, however, have met satisfactorily all of the requirements of the trade, and their introduction has been effected to a limited extent only.

The machine shown in our illustration is claimed to be practically perfect in its operation, upward of two years having been spent in perfecting every detail of the machine and bringing it to the high standard which it has attained.

The machine is based on a principle radically different from any cutting machine that has heretofore been devised, and, as claimed by the inventor, the great success of the machine is due to this novel principle of action.

Instead of being laid on a solid wooden table, as usual, the layers of cloth, piled up to a height of from two to four inches, are placed upon a bed or support consisting of rows of upright wires fastened to a backing of wood, the wires being cut to a uniform length, so that their upper ends present a perfectly level surface.

The working parts of the machine are mounted on a firm base, alongside of and independent of the supporting bed, and are constructed to travel over a surface fifty or more feet in length, if desired.

The cutting instrument cuts upward instead of downward, and can be freely moved in any direction so as to follow the lines of a pattern marked on the top layer of cloth, the peculiar character of the supporting table permitting this movement without difficulty.

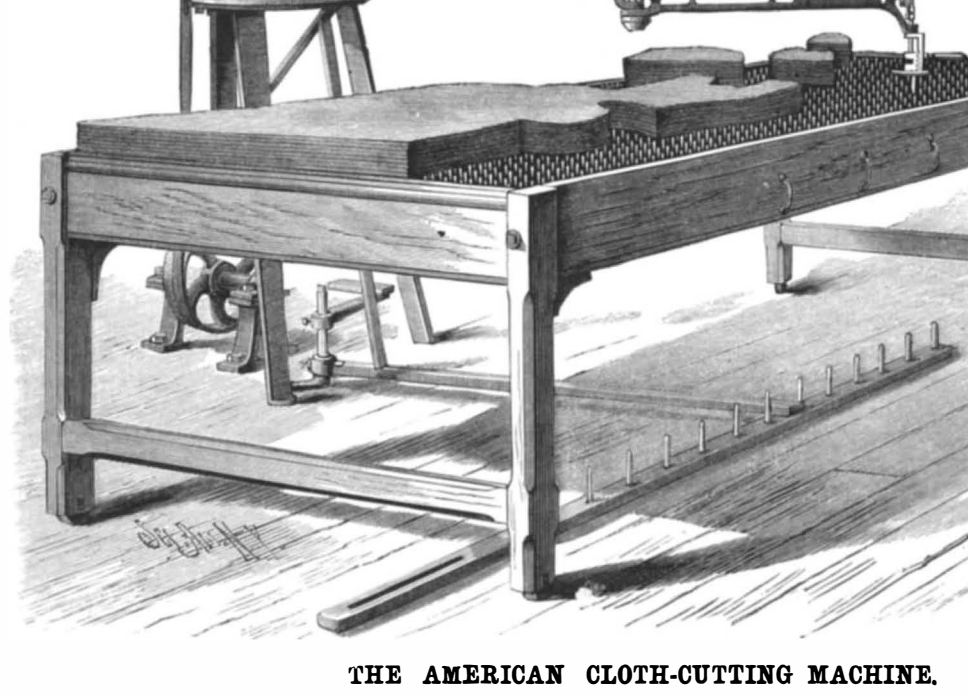
The machine has been in use in Philadelphia for some months past, and has been examined by numerous manufacturers from different parts of the country, who have been unanimous in their indorsement both of the machine and its work.

The machine now in use, driven by a two-horse power engine, works with wonderful rapidity and accuracy, the knife easily following the most intricate designs and cutting through thirty-four thicknesses of heavy cloth without apparent effort. As the cloth is not lifted from the table while being cut the arrangement of the layers is not disturbed and the cuts are perfectly uniform in each layer, and as the movable parts of the apparatus are above the cloth the manipulation of the machine is effected without that friction or drag which attends the operation of an ordinary cutting machine.

The machine has an estimated capacity of 2,500 coats per day, or a product equal to that of 25 skilled cutters.

With this machine is an attachment for accurately cutting, without previous marking, from one to two hundred strips of materials of any width at a single cut, and cuts them either on the bias or at any angle across the pile of goods. They are very convenient for seam binding and other purposes. The attachment travels on the side of the table, and is connected when in use to the pressure foot of the machine, which it causes to pass in a straight line.

The machine is the invention of Mr. W. R. Fowler, the inventor of the well-known Fowler fly fan, and is manufactured by Mr. Martin J. Myers, of 819 and 821 Market street, the owner of the patents, who may be addressed for further information.



THE AMERICAN CLOTH-CUTTING MACHINE.

THE NEW ASTRONOMER ROYAL.

Mr. William Henry Mahony Christie, who has succeeded Sir George Airy in the office of Astronomer Royal at the Royal Observatory, Greenwich Park, was born on October 1, 1845, at Woolwich. He is a younger son of the late Professor S. H. Christie, of the Royal Military Academy, Woolwich, and formerly Secretary to the Royal Society. Mr. W. H. M. Christie was educated at King's College School, London, and at Trinity College, Cambridge, which he entered in 1864, having won a minor scholarship of that college; he subsequently gained a foundation scholarship, and was afterward elected a fellow of Trinity College. He took his degree of B.A. in 1868, as fourth wrangler in the Mathematical Tripos, and in 1871 proceeded to the M.A. degree. In 1870, Mr. Christie was appointed chief assistant at the Royal Observatory; and he has, during the past ten years, done special good service by contriving and introducing several valuable improvements in the scientific apparatus there in use. A new form of spectroscope, an instrument for determining the colors and brightness of the stars, a recording micrometer, and a polarizing solar eyepiece, are to be mentioned as his inventions. In the recent address of the President of the British Association, at York, a passing reference was made to Mr. Christie's work in verifying the results obtained by Dr. Huggins, with regard to the motions of stars, as inferred from spectroscopic observations The new Astronomer Royal has directed particular attention, at the Royal Observatory, both to spectroscopy and to photography, as a means of recording the observations. He is a fellow of the Royal Society, and was elected Secretary of the Royal Astronomical Society last year. He contributed to the proceedings of the Royal Society, in March, 1877, a paper "on the magnifying power of the half prism, as a means of obtaining great dispersion, and on the general theory of the half prism spectroscope." To the monthly notices of the Royal Astronomical Society he has furnished these: in June, 1873, a paper on the recording micrometer; in January, 1874, on the color and brightness of stars, as measured with a new photometer; in May, 1875, on the determination of the scale in photographs of the Transit of Venus; in 1876 (January) on a new form of solar eyepiece; (May) on the displacement of lines in the spectra of stars; (November) on the effect of wear in the micrometer screws of the Greenwich Transit Circle; same year (December) on the gradation of light on the disk of Venus; in 1878 (January) on specular reflection from Venus; (June) on the existence of bright lines in the solar spectrum; in 1879 (January) on a phenomenon seen in the occultation of a star by the moon's bright limb; in 1880 (November) on the spectrum of Hartwig's comet of that year; in 1881 (January) on Mr. Stone's alterations of Bessel's refractions; (May) on the flexure of the Greenwich Transit Circle, and some further remarks on Mr. Stone's alterations of Bessel's refractions; besides various papers on the Greenwich spectroscopic and photographic observations, communicated by the late Astronomer Royal; and a paper which will be found in the Memoirs of the Royal Astronomical Society, published in January, 1880, on the systematic errors of the Greenwich North Polar distances. Mr. Christie is also the founder and editor of a journal entitled *The Observatory, a Monthly Review of Astronomy*, which has been published during the past four years; and he is author of the "Manual of Elementary Astronomy," published in 1875 by the Society for Promoting Christian Knowledge. These particulars we gather from the *Illustrated London News*, and our portrait from the London *Graphic*.

PROFESSOR W. H. M. CHRISTIE, F.R.S.,
The New Astronomer Royal.

MISCELLANEOUS INVENTIONS.

An improved fastening or locking device, especially designed to endure without injury the excessive strains that trunk locks are subject to, has been patented by Mr. David W. Eggleston, of Terryville, Conn. The invention consists of a laterally swinging unjointed hasp, designed to be pivoted on the body of the trunk, having a large opening in its free end that sets over and coincides with a socketed and perforated nose or lock plate which is designed to be fixed on the trunk cover.

An improved electric lock has been patented by Messrs. William R. Manierre and Henry B. Porter, of Chicago, Ill. The object of this invention is to provide an electrical attachment for locks, which will indicate at once the surreptitious opening of the lock by other means than the key.

An improved folding leaf extension table has been patented by Mr. John Bismann, of Fairview, W. Va. It consists in the peculiar construction and arrangement of the parts, the extra leaves being folded within the table and always ready for use.

Mr. William Weiss, of New Orleans, La., has patented an improved and simple device for opening tin cans, which device can be used as a cover for the opened cans. The invention consists in a circular plate of metal provided with a flange, and with a pointed or sharp edged tooth or stud a short distance back of the edge, and projecting in the same direction as the flange, and with a handle on the opposite surface, which plate is pressed upon the head of the can, so that the stud will pass through the head, when the plate is turned by means of its handle, causing the sharp stud to make a circular cut in the head of the can.

An improved cigar maker's working board or table, which is handy and compact and can be transported very conveniently, has been patented by Mr. Bernhard Becker, of New York city.

Mr. Heinrich A. W Braune, of Memphis, Mo., has patented a cheap and efficient solar camera, which is light and portable, and may be readily taken apart or set up, as required. Any ordinary tube may be used in the instrument, and no extra tubes are required. The print being detached from the camera box, the printing may be watched and the light regulated according to the shades desired. The instrument may be readily handled and managed by one person.

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PATENTED IMPROVEMENTS IN JEWELRY.

We give illustrations of a few recently patented improvements in jewelry. The invention shown in Fig. 1 is an improved method of incrusting and enameling precious stones, such as onyx and agate. It consists in first engraving the design into the stone to be ornamented, then pressing or moulding a thin plate of gold into the indentation, then removing, enameling, and burning the plate, next replacing and cementing the plate into the stone, and finally grinding the surface of the enameled portions flush with the surface of the stone. This is the invention of Messrs. Peter Appel and Charles P. Appel, of West Hoboken, N. J.

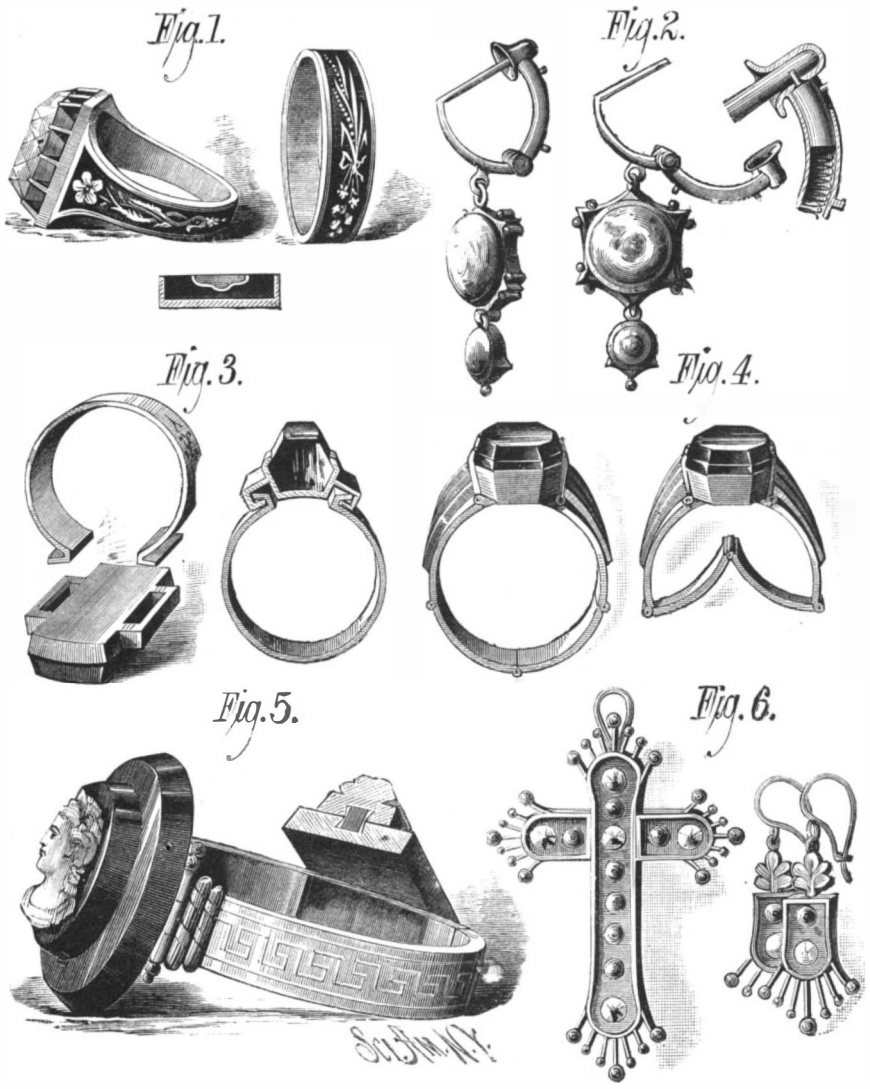
Fig. 2 represents an improved fastening for ear jewels, patented by Mr. G. W. Washburn, of West New Brighton, N. Y. In this invention a neat and inconspicuous curved tube is made to inclose, conceal, and protect the bolt and spring of a secure locking device, adapted to fasten automatically with a distinct "click," which gives audible notice to the wearer when the ear wire is locked. The ear fastening is readily unlocked by the wearer or an attendant. The engraving shows the fastening both closed and open, and gives also an enlarged sectional view of the fastening.

Mr. David Untermeyer, of New York City, has lately patented an improved separable finger ring, shown in Fig. 3. This finger ring is so constructed that the shanks can be detached from the heads and replaced with larger or smaller shanks. The head has sockets upon its inner side, and the shank has hooks upon its ends, so that the setting may be detached and replaced by another at the will of the wearer. The engraving shows the ring and setting separately, also a sectional view of the two parts put together.

Fig. 4 shows a combined finger and scarf ring, patented by Mr. Carl Bachem, of Pforzheim, Baden, Germany. This is an improved finger ring, which can be used in a convenient manner as a scarf ring without any extra fastening device. The invention consists in making the ring in five parts, which are hinged together so that the two hinged sections opposite to the central stone setting may be sprung inwardly for use as a scarf ring. The hinged sections adjoining the stone setting are provided with raised cheeks, which abut against the setting when throwing the remaining sections in outward or inward direction.

An improved method and device for connecting gems, patented by Mr. August Schaffer, of New York City, is shown in Fig. 5. The object of this invention is to connect agates and similar stones of natural or artificial color, cameos, and the like, in such a manner that the upper stone projects above the surface of the lower stone or table. By this connection a larger variety of combinations can be made from this class of stones, to be used for articles of jewelry and other purposes. The improvement consists in connecting two agates or other stones by recessing or dovetailing the lower stone or table on its upper surface and the upper stone or step at its bottom surface, inserting into the recess a connecting piece or key of copper, and filling up the small wedge-shaped spaces or cavities between the connecting key by electro-deposition.

Fig. 6 shows a very pretty article of jewelry that may be changed so as to be used for different purposes. This piece of jewelry is made in the form of a cross, with detachable side pieces, pin, and hanger, so that by removing the side pieces the middle piece can be used as a lace pin and the side pieces as earrings. This invention has been patented by Messrs. Leon P. Jeanne, of Woodside, and Louis P. Jeanne, of Greenville, N. J.



IMPROVEMENTS IN JEWELRY.

NEW INVENTIONS.

Mr. John Flinner, of Millersburg, Ohio, has patented an improvement in gates. The object of this invention is to combine with a vertically swinging gate a suitable latching device adapted to be operated by the lifting rods and the levers by which the gate is raised. The gate has a stationary latch near the bottom of its swinging end, and a sliding latch near the top of same end, in combination with a recessed gate post and suitable mechanism for operating the sliding latch and raising the gate.

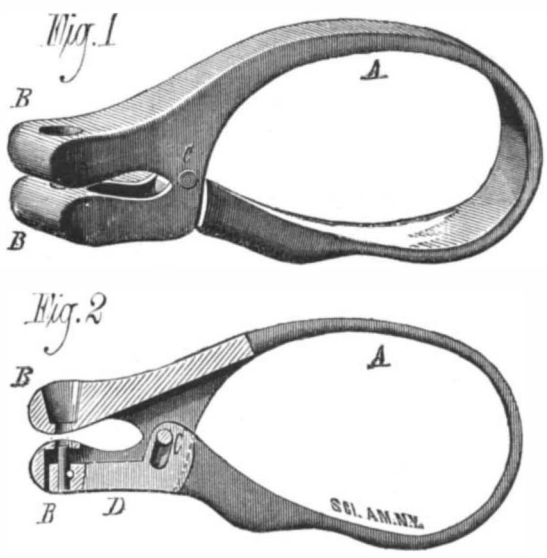
An improved loom shuttle has been patented by Mr. John W. Sohn, of Columbia, Pa. The invention consists in the combining, with a shuttle body and vertical spindle, of an end perforated lever and a subjacent spring.

An improved butter worker has been patented by Mr. Elvearo Stout, of Ottumwa, Iowa. This invention relates to improvements in that class of butter workers in which a frame carrying a roller is reciprocated in a box having slots in its sides, the bottom faces of the slots serving as bearings for a transverse rod in the roller frame as it is moved back and forth in the box.

Mr. John Murray, of New York city, has patented a toy wagon with a figure of a driver having a hinged body, and connected by a rod with a crank formed upon the forward axle, so that the movement of the wagon will give the figure the appearance of whipping the horses; and also with a figure of a boy connected with a crank formed upon the rear axle, so that the movement of the wagon will give the figure the appearance of jumping up at the rear end of the said wagon.

NEW TICKET PUNCH.

The engraving represents a novel ticket punch recently patented by Mr. George A. Gunther, of Bath, and William Kowalski, of Brooklyn, N. Y.



GUNTHER'S TICKET PUNCH.

The object of this invention is to simplify and cheapen the construction of ticket punches and to make them convenient to carry.

The ticket punch has a curved spring and jaws made in one piece, the upper jaw having a groove to receive the lower jaw, a curved recess to receive the ticket and carrying the female die, and the lower jaw carrying the male die and having a slot to receive the stop pin that limits the movements of the jaws.

Fig. 1 is a perspective view of the punch, and Fig. 2 is a sectional view.

A Carload of Blasting Powder Exploded.

A remarkable explosion occurred at Council Bluffs, Iowa, Sept. 26. A car laden with blasting powder consigned to Denver had been refused by the Union Pacific Railway Company and returned to the yards of the Chicago and Rock Island and Pacific Railroad, where from some unknown cause it was exploded. The concussion demolished the company's round house, repair shops, brick freight houses, and about forty or fifty freight cars. The explosion dug a hole in the ground fifteen feet deep and forty-five feet in diameter. Large windows in all parts of the city were shattered, sheets of plastering were torn from houses, and damage was done in all directions. Even in Omaha, on the opposite side of the river, large windows were broken by the concussion, and as far as the Missouri Valley, twenty miles north of Council Bluffs, the damage done was heavy.

Accidents to Railroad Employes.

British railroad accidents during the first three months of the current year are reported to have killed 269 and injured 1,078 persons. These accidents, however, include injuries to persons on the track, etc., by trains, as well as train accidents. There were but 3 killed and 276 injured by the latter, against 17 killed and 225 injured in the first quarter of 1880. The comparison with the accidents in this country, as reported in our columns, is as follows:

	1881.		1880.	
	Killed.	Injured.	Killed.	Injured.
United States	95	612	36	132
Great Britain.....	3	276	17	225

We were working something more than five times as many miles of road as there were in Great Britain; but our train-mileage was not by any means large in proportion. The *Railroad Gazette* says: The result in 1880 was decidedly favorable to this country; but for this year it is extremely unfavorable, our train accidents having killed *thirty-two* times as many and injured more than twice as many as the British train accidents. We may comfort ourselves somewhat by the reflection that last winter was extraordinarily unfavorable and productive of accidents.

Discovery of Beautiful Minerals.

Prof. B. Silliman records, in the *American Journal of Science*, the discovery of vanadinite and other crystalline salts of lead, of great beauty of color and perfection of form, in the Territory of Arizona. Some of the varieties—crocoite, a chromate of lead, and vauquelinite, a variety containing copper—have never before been found in North America. Vanadinite, chloride of lead, and vanadium, hitherto a rare species, promise now to be comparatively abundant in the silver district in Yuma county and other localities.

It is found in veins of quartz which lie between foot walls of granite and hanging walls of porphyry, the latter being similar to the usual associates of silver ore the world over. The quartz veins have also other salts of lead and argentiferous galena, but no gold. Vanadinite occurs in the "Hamburg," the "Red Cloud," and the "Princess" mines. That in the "Hamburg" is the best. The crystals are small and highly lustrous, varying in color from deep orange-red to reddish-yellow and brown.

In "Red Cloud" they are a rich flame color, and are found in rather confused masses. In "Princess" mine occur slender crystals of a brilliant red color bedded in white calcite. They are very perfect in form, and have been mistaken for chromate of lead.

Other rare species are found in the *Vulture District*, in the vicinity of the "Vulture" mine, while at "Collateral" mine, about twenty-five miles northeast of "Vulture," is the most interesting locality. The vein is about four and one-half feet wide in soft gray talcose rock. About one-half of the thickness of the vein is quartz stained green with chrysocolla and chocolate-brown with ground mass which contains vanadium. The colored masses all give strong reaction for vanadic acid.

A seam of very red ferric oxide and calcite follows next. The calcite contains crystals of vanadinite, and the oxide reacts for vanadic acid; then there is a seam of lemon-colored crystals. The whole soft mass of the vein reacts for vanadic acid, and specimens of rare beauty are found in the cleavage fragments of the calcite.

Among the ores found in this "Collateral" mine is a mineral which may prove to be descloizite. The tests of it indicate the presence of vanadium, lead, copper, manganese, and zinc, but more specimens are needed to complete the study of it.

A specimen is referred provisionally to the volborthite species.

This mineral has a green color, and contains copper, lime, and vanadic acid. It was named after Volborth, its discoverer; but the specimen discovered in "Collateral" mine may turn out to be a new species.

A mineral like Domeyko's *chileite*, but not a clay-like mineral, which yields a globule of lead containing a nucleus of copper, occurs both in this mine and in the "Chromate," and something similar also is found in the "Phœnix" mine. The Montezuma lead mine abounds in vanadinite in the form of hexagonal prisms.

What may prove to be *mottramite* has been found at the "Frenchman's" mine. Wulfenite, molybdate of lead, which does not contain vanadic acid, has been found in crystals of rare beauty in "Red Cloud" mine, as well as the vanadinite before mentioned. It is also found in the "River" mine.

Three or four species of the *crocoite* group, that is, chromic acid with oxide of lead, occur in the "Collateral" and the "Chromate" veins, but as yet it has not been found

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well crystallized. Before the study of these interesting localities can be complete a personal visit must be made by a mineralogist to the mines and sufficient material obtained on the spot to allow of a chemical analysis.

Correspondence.

A Stroke of Lightning.

To the Editor of the Scientific American:

Your article of August 6, describing the lightning stroke at Manhattan Beach Hotel, calls to mind a similar occurrence at Masonic Temple a few years ago.

The flagstaff, about fifty feet high, on the central dome, had at the top a gilded ball. It was struck by lightning soon after it was put up, and about twenty feet of the top of it was broken off and thrown two hundred feet from the building, leaving a tall splinter on a stump.

The metallic ornamental cresting of the dome had been carefully gilded, and connected with the sewers of the city, through the cast iron water conductors of the building, by means of twisted copper rods, about three-eighths of an inch by three-fourths of an inch, in anticipation of possible lightning strokes.

The missing portion of the staff above the stump and below the top of the tall splinter was reduced to matches and toothpicks, and scattered upon the main roof of the building.

The track of the fluid was marked upon a portion of the original surface of the spar remaining on the splinter by a spiral line scorched on the wood, but below a point six feet above the iron band, to which the guys were attached, no marks were seen to indicate that the spark had followed the wood to its connection with the iron.

The gilded ornaments of the cresting were twelve feet at least from the point where the track disappears from the wood, so that if the fluid left the spar to follow the prepared lightning conductors, and rejected the course through more direct metallic connections, there must have been strong reasons for its preference.

I write this hoping you may have something more to say on the subject of protecting buildings, as well as persons and animals, from the capricious action of lightning. Its freaks appear to be little understood by the public.

New York, September, 1881. JOHN W. KELSEY.

Encke's Comet.

This celebrated periodic comet is now in a favorable position for observation in the eastern sky after midnight. Its period is the shortest of any known comet, making its revolution about the sun in three and one-third years. It has no tail, but presents a round flat disk, slightly condensed near one edge, ill-defined, and brush-like upon the opposite edge.

The comet's position in an observation made by me yesterday was right ascension 6 hours 42 minutes; north declination 42 degrees 54 minutes. This brings it on a line drawn easterly from Capella through Beta Aurigæ and about one and a half times as far from Beta as Beta is from the first named star. It is at present moving about three degrees daily in this direction—a very little south of east. On October 1 its position will be R. A. 8 hours 2 minutes, + 42 degrees 5 minutes, or about 10 degrees northeast of the well known star Castor. On October 10 it will be in Leo Minor, R. A. 9 hours 51 minutes, + 34 degrees 50 minutes. October 20 the comet will be in R. A. 11 hours 31 minutes, + 19 degrees 59 minutes, or about 4 degrees north of Denebola or Beta Leonis.

This very interesting comet may be well seen with moderate sized telescopes, and will amply repay the trouble of picking it up. It is quite a bright object in the five inch aperture reflector. A three inch refractor with a good low power or comet eyepiece should readily show it. It is visible with an aperture reduced to two inches.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,
September 26, 1881.

An Erratic Season.

Of the first eight months of 1881, four—January, February, March, and June—were decidedly wet, the rainfall exceeding by six inches the average of the corresponding months for a period of forty-one years. April, May, July, August, and September have been exceptionally dry, particularly April and August. During these months the rainfall was over ten inches below the average. The record by months for the longer and shorter periods named, as compiled by Dr. Draper, Central Park Observatory, stands as follows:

	41 years. Inches.	1881. Inches.
January	3·30	4·80
February	3·40	4·93
March	3·76	5·81
April	3·80	0·95
May	4·51	3·20
June	4·13	5·35
July	4·02	1·25
August	4·74	0·86
Average total	31·66	27·15

The maximum rainfall, in forty-one years, for the month of August, was 15·26 inches in 1843, and the minimum this year 0·86 inch. The maximum for April, for the same period, was 9·05 inches in 1857 against 0·95 this year.

STEAM ENGINE NOTES.

At the last weekly meeting of the Polytechnic Association of the American Institute, the President, Mr. Stetson, read an abstract from one of our technical journals, in which a correspondent avers that he runs an engine of 5 inch stroke at 600 revolutions, and has run it for a short time at 2,000 revolutions per minute. The diameter of the cylinder is 5 inches.

Mr. Sutton said the high velocity of piston was one of the marked innovations in modern engines, but these figures were extreme, and undoubtedly far beyond what was good policy. An Allen engine, 12 inch stroke, in one of the recent fairs of the American Institute, made 500 revolutions per minute regularly. High speed was one of the elements which has lowered the cost of fuel from 8 lb. to 2 lb. per horse-power per hour. Our Corliss engines, running at about the old rate of speed, have, in many cases, got considerably below 2 lb. per actual horse-power; and the Buckeye, a quick running engine, has got down very close to it. The Wheelock engine, at the late Millers' Fair in Cincinnati, had stood high among a host of excellent competitors, and had, with a high velocity, regulated so perfectly as to vary less than one of its quick revolutions in suddenly changing load from running light to ten-horse power. Even speed was of great importance in spinning fine thread, especially silk.

The tendency of the parts to change their dimensions and proportions by springing under great strains at high speeds was referred to. One speaker knew a modern upright engine, considered the acme of proportion and stiffness, to be sprung enough when heavy loaded to change the relation of the parts, and introduce obviously defective working. It was always all right when examined cold, and when worked slowly and lightly.

Steam-engine packing, was the subject of a brief paper by L. F. Lyne.

The paper referred to the difficulty encountered in the fact that almost all piston-rods are not true, and cites an instance in which the piston-rod, 12 inches in diameter, was out of the center of the cylinder about three-eighths of an inch, and varied in diameter about three-sixteenths of an inch. This rod was neither perfectly round nor straight, and was run at a high speed. This is a worse than ordinary example, but it is well known that it is almost impossible to get a piston-rod perfectly accurate. Piston-rods that have been long in use will, as a rule, be found smallest in the middle, and of an oval shape at the ends. It has been found, from experience, that the follower ends of a rod will be worn most upon the bottom, while the crank end will be most worn upon the top. All these causes make it hard to make the packing steam-tight.

It is customary upon locomotives, when putting in a new piston and rod, to set the piston about one thirty-second of an inch high, thus destroying the perfect alignment at once.

On locomotives new piston-rods are sometimes nearly destroyed within forty-eight hours after they leave the shops. This is caused by the use of hemp that has gritty substance in it. So long as a piston remains in line there is little difficulty in keeping it tight with a good quality of fibrous packing which is entirely free from grit, but as soon as the glazed surface upon the rod is abraded or the parts get out of line it begins to cut and constant trouble may be expected.

The paper referred at some length to the very early use of metallic packing. A patent was taken by one Cartwright, November 19, 1797, in which he described flat matallic plates cut into segments, which were pressed against the piston-rod by steel springs in the shape of the letter, U. The first of which we have any authentic account of the pressure of the steam itself being used to hold the packing tight is in a patent to F. J. Johnson, February 10, 1863. This system has been developed by many subsequent inventors, and has proved to be highly satisfactory.

The present and most approved forms of metallic packing make use of this feature, and have a partial ball joint to allow of slight changes in the angle and positions of the piston-rod. A strong spring in one form or another is generally used to insure that the packing rings of soft metal remain in their position, bearing fairly against the rod. The substance of the soft metal rings has to be very carefully looked after. If lead or soft metal is used, grit will embed itself and wear away the rod, but when a proper mixture of anti-friction metal is obtained, it avoids this difficulty and shows great durability.

The cotton packing largely used in the steamers in New York waters for piston rod stuffing boxes was explained and drawn on the blackboard. It is by a recent improvement braided square and required but little compression to make it fit nicely when bent around the rod in the box. Much of it is now made of all cotton, the old core of square rubber being found to be of little account. The nature of cotton is to wear long and create a smooth surface of little friction. It is saturated with tallow and plumbago.

Mr. Sutton gave his experience with hemp packing for the piston head of a high pressure engine of some twelve inches diameter. It needed renewal every day or two days, but he liked it.

The President said modern improvements in boring and fitting had made elasticity far less necessary than of old in a packing for the body, or head, as some term it, of a piston. A perfect fit of metals together without any yielding was absolute perfection if the parts could be kept in this condition. Fulton's metallic packing, many years used and probably still used in large high pressure steamers on the Ohio River, was on this principle with simply peculiar means to make the fit. Soft metal rings were compressed by the follower of the piston and caused it to gush out till they just fitted; no elasticity was allowed anywhere. There was a patent on it, or, rather, on the use of thin copper or brass rings at the edges to keep the plastic metal from dragging out by the friction, but it had long since expired. Andrew Fulton, of Pittsburg, was the patentee, and used to supply it, and was very successful in getting the alloy just hard enough to serve properly.

The Michigan Fire.

The burning of the village of Bad Ax, the seat of Huron County, illustrates the awful suddenness of the assault of wild fire on most of the fated settlements and the completeness of the destruction wrought. A correspondent of an Eastern paper says:

It began to grow dark in the forenoon from smoke, and in a few hours the pitchy blackness was like that of a close cellar, so that it was impossible to see a foot. It was known that there were fires three miles south, but there was no thought of danger until suddenly there came a lurid glare, the flame and wind immediately followed, and in thirty minutes fifty-three of the fifty-five buildings in the place were in ashes. The courthouse was of brick, covered with slate, and there people went for protection. The building escaped destruction, and those within it were saved, although they suffered badly from heat. There were no lives lost here, but this was exceptional good fortune. Reports from some places are too horrible to read. Numbers of people flying from danger were overtaken and died in the roads, some perished miserably in wells and other places where they had sought safety, and in the terrible time a few women were taken with the pains of childbirth. Everywhere it is a sickening story of suffering and of roasting human flesh in every conceivable way. In some places the heat was almost incredibly intense, and the smoke was everywhere unendurable and caused many deaths by suffocation.

The work of destruction was very uneven. Some towns in the district escaped with a loss which seems trifling, while in others, apparently no more exposed, there are but a few scattering buildings left. The same was true of the villages, some strangely escaping, while others were strangely destroyed. In some fields the grass roots, and, it is said, the soil itself are burned so that it is impossible to tell whether the land was plowed or not, while in others near at hand crops of grain are left in the shock untouched.

A remarkable thing in the story of the calamity is the presence of mind that was everywhere shown. The people were accustomed to danger from fire, many of them had been through the similar experience of 1872, and there were fewer lives lost than might have been expected. There seems to bave been but little panic and few threw their lives away. Nearly all sought to preserve themselves and property intelligently, to have done about the best that was possible and very much better than could have been expected. Domestic animals and fowls nearly all perished, and it is noted that they died in groups, each with its kind; rarely did cows, horses, or chickens die alone, but all sought the companionship of their kind. Great numbers of birds and insects took their way to the lake, and, overcome by the smoke no doubt, died and were found floating on the surface.

The Presidential Bullet.

In reviewing the case from an autopsical standpoint, it is quite easy to offer criticism. The stubborn facts of a *post-mortem* always stand out in bold relief against decisions rendered *ante mortem*. But it must be recollected that there were peculiar difficulties in the case. They are best appreciated by all who have had experience in the treatment of gunshot wounds. However greatly we may regret that, in view of the great public importance of the case, a correct opinion as to the course of the ball was not made at the beginning and was not proven at the end, it is quite difficult to see how the error could have been avoided. There were no symptoms during life to point to the locality of the ball. But, even at the worst, as proving that the surgeons never knew during the life of the patient where the ball was located, there is nothing to show that in consequence of that error the patient suffered. The ball itself, by being firmly encysted, became harmless, while the real cause of all the trouble had its origin seemingly in the comminution of the eleventh rib. It is a matter for much congratulation that the bullet was not found in a pus-cavity. Under such circumstances, even if it were impossible to remove the bullet, there would have been many who would have claimed that such an operation should have been attempted, or at least that the neglect to resort to such a procedure was indirectly the cause of the patient's death. But all doubts in such a direction are cleared up by the autopsy. On the supposition that the ball should have been extracted in any event, what have we not escaped? At least the wisdom of not cutting down upon the missile until the locality of the latter was clearly made out, cannot be gainsaid. As nearly two hours were consumed in finding the ball at the autopsy, what might have been the chances of extracting the missile during life?—*Medical Record.*

The St. Lawrence Tunnel Scheme.

Notice was recently made of a scheme for tunneling the St. Lawrence River at Montreal. It is now reported that the scheme is likely to be abandoned in favor of a bridge, the English member of the Tunnel Company having joined a railway company holding a charter for a bridge across the St. Lawrence near Lachine.

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THE RAUB CENTRAL POWER LOCOMOTIVE.

[*Continued from first page.*]

the whole system of construction could lead to success; any improvement upon the original design, no matter how great, could not overcome the faults or disadvantages which were inherent in the system as a whole.

Dr. Raub, in order to definitely locate the center of gravity, has constructed his engine in such a manner that each half of the total structure, whether divided longitudinally or laterally, is an exact counterpart or duplicate of the other half, both as regards weight or measure; the consequence of this is that the center of gravity is in the intersection of the longitudinal and transverse center planes of the entire locomotive; and by placing his motive power in the central transverse vertical plane of the engine he has disposed the parts of his locomotive to the best advantage for economy and efficiency.

The engravings represent the invention so clearly as to require but little explanation. The whole engine rests upon an oblong platform which extends all around the structure, and which is made wider in the middle to support the engineer's cab, which will be as wide as the cabs now in use; at each side of the engine is a boiler extending longitudinally to the end of the locomotive, each boiler having a separate firebox, which is located in the cab. The boilers have ordinary flues, which terminate in a smoke chamber at the extreme ends of the locomotive, but instead of allowing the heat and gases to escape through smokestacks at the ends, as in the present locomotives, they are conducted through return flues of a larger size (as shown in Fig. 3) to an interior collecting smoke chamber, which thus collects the smoke and gases from both boilers, and allows them to escape through one common smokestack which stands above it. This collecting smoke chamber extends upward and downward vertically through the entire locomotive, and serves not only as a brace to the steam dome which surrounds its upper portion, but also gives an additional support and strength to the entire structure. The steam dome stands in the center of the locomotive, its axis being the exact center of the engine. It is stiffened by the collecting smoke-chamber which extends through it. A separate valved connection is made through this interior smoke-chamber for the steam as well as for the water in the boilers, so that both steam and water can circulate freely from one boiler to the other, or may be shut off if it is desired to use one boiler only. The steam cylinders are vertical, and placed outside the steam dome, their axes being in the vertical transverse plane extending through the center of gravity of the locomotive, and preferably placed as high as possible, so as to take the steam by means of pipes which receive their steam supply from a common opening at the highest point in the steam dome, the opening being closed by a throttle-valve operated in the usual manner. The steam chests are placed inside the dome as shown in Fig. 3.

The driving-wheels are situated equidistant from the center line, and upon them rests the whole platform, and in the center-line, and as near the rails as possible, is placed an intermediate driving shaft, to the cranks of which, on opposite sides of the locomotive, extend the connecting rods from the cross-heads of the piston rods above. The cranks of the two drivers on each side of this vertical connecting rod are connected in the usual manner by a horizontal driving rod, which, near its center, extends downward to the crank of the intermediate driving shaft and is connected with it. The driving rod is slotted in its center to allow the vertical connecting rod free play.

The eccentrics are placed upon the intermediate driving shaft, while the link motions are arranged on an auxiliary shaft vertically above it.

The locomotive may have horizontal cylinders, if they should be preferred. In that case they would be placed lower down in a line with the center of the driving wheels, but in the same central position.

At each end of the locomotive the frame rests upon a truck, but as the whole engine is evenly balanced upon and supported by the driving wheels, the object of the trucks is not so much to support any specific weight, as in other locomotives, as to serve as a guide over curves. Each end truck has one transverse axle with one pair of wheels and a frame which incloses the wheels and is connected by an arc-shaped guide piece, which is transversely guided in a fixed center box at the end of the locomotive.

The water tanks are below the boilers, openings being provided to allow the axles of the wheels to pass through. The fuel is carried in bunks arranged sideways and above the boilers.

A novel and ingenious plan is devised for feeding the boilers. The return flues being situated but a few inches below the water level, it is important that the level should be continually kept up. The inventor has, therefore, arranged a steam pump, which is worked by a lever connection with the main piston, and which injects into the boilers at each stroke of the piston the equivalent of water for the steam used.

These are the main features of this novel engine, which the inventor claims as the first locomotive built upon strictly scientific principles.

The advantages claimed for this new style of locomotive, and to which Dr. Raub has given the appropriate name of central power locomotives, are numerous.

This engine has no dead weight, therefore its whole power can be utilized for drawing freight; and it is claimed that a central power locomotive of any given size will do more work than another locomotive of the same size under the same conditions. The heat is better utilized, as it is led back through the boiler by means of the return flues, and the fuel will be more fully consumed than it is now. The collecting smoke chamber, which extends upward through the steam dome, serves to superheat the steam, consequently dry steam will be obtained, and the steam chests being inside the dome, no loss of steam from condensation will take place. Should an accident happen to one of the boilers, the connection between the two may be interrupted, and the remaining boiler will be sufficient to propel the train to the next station, thus preventing blocks on the road and delays to traffic.

It is claimed that a train may be run at a much higher rate of speed with this engine and with much more safety than now, owing to the balanced driving wheels and the peculiar relation of the parts; and there is less danger of breaking the driving rods and less strain upon the track.

A separate tender will not be required, as both water and fuel are carried upon the locomotive itself; and, furthermore, turn-tables with their necessary attendance will become superfluous, since the locomotive is a perfect double-ender, and runs in either direction with equal efficacy and without any damaging effect to the gearing.

We understand that Dr. Raub is now making arrangements to build several locomotives according to his new system of different patterns and sizes, in order to practically test their merits and superiority and to ascertain the actual percentage of saving in running them.

The doctor has for many years been identified with several large Western roads, and is well known as a prominent and able railroad engineer.

New Railway Ventilating Apparatus.

The system of ventilating cars devised by Mr. Andrew J. Chase, of Boston, was put to a test on a car on the Boston and Albany road, Sept. 12, which is thus described by the Boston *Herald:*

"The 11 o'clock express train for New York was taken. Accompanying Mr. Chase was Mr. William B. Lindsay, assistant in the chemical department of the Massachusetts Institute of Technology, and Mr. Adams, the master car-builder of the Boston and Albany Railroad.

"Mr. Lindsay went for the purpose of measuring the velocity and volume of the air coming into the car by the supply pipes, and the velocity and volume of the vitiated air expelled, while the train was in rapid motion. The following is a brief description of the apparatus used in this system. There are two general principles involved in it: One, the supply of fresh air, freed from dust, cinders, etc.; the other, the expulsion of the foul air generated by the lungs and bodies of the occupants of the car. The air, as the train passes rapidly onward, is caught by a kind of scoop, or mouth, and is forced, cinders and all, downward through a pipe into a reservoir, where it strikes the water contained therein with sufficient force to be driven through it. After being thus cleansed and cooled the air is forced, by the pressure of the descending column, upward through another pipe or funnel, and discharged into the body of the car. This air, being pure and cool, naturally gravitates to the bottom of the car, displacing the warmer vitiated air, which then ascends to the top of the car, where it is got rid of by an ingenious device. This consists of two long pipes or tunnels laid upon the outside of the car, on each side of the monitor top. These tunnels are jacketed at both ends by a larger pipe, having a kind of bell mouth, to better gather in the air. Through these outer bell-mouth tubes—that is, the rear ones—the external air rushes with a velocity proportioned to the momentum of the car.

"This air, by its rapid movement, serves to siphon or pump the vitiated air out of the car, the tunnel used being connected with the interior of the car by small siphon pipes through which foul air is thus withdrawn. There are valves at both ends of the tunnels, which act automatically, the ones in front being closed by the pressure of the atmosphere, when the car is put in motion, while the rear ones are opened by the same pressure being exerted through the bell-mouthed jackets. The trip to Worcester showed how well the apparatus worked. The air in the car was kept sweet and pure, and it was absolutely free from cinders, dust being out of the question, as the recent rains had laid it. The trial was made under some disadvantages, the principal being that the induction pipes were of small caliber, and therefore the supply of air was, to some extent, limited. This, however, proved no defect in the system, but rather showed that any amount of air desired could be obtained by the enlargement of the induction pipes to the proportions desired. As it was, however, the day being cool and cloudy, the supply of air was ample to keep the atmosphere of the car fresh and clean. It may be stated that, by this system, in the hot summer weather, not only could the air of the car be kept pure and free from dust and cinders, but it could be cooled to a delightful temperature by the use of ice in the reservoir, or what would, perhaps, be better, ice and water combined.

"The following is the result of Mr. Lindsay's tests, as given by himself:

"'The velocity of the air entering through the ventilating pipes and also of that passing out through the exit flues was taken at several different times. The mean of these results thus obtained gives, I think, a fair determination of the amount of pure air entering and vitiated air leaving the car.

"'Mean of several determinations of the velocity of the air entering the car by the ventilator pipes, 1,243 feet per minute.

"'Mean of several determinations of the velocity of vitiated air leaving the car by exit pipes, 768 feet per minute.

"'Mean amount of air entering by ventilator pipes, five inches in diameter (two in number), per minute, 340·6 cubic feet.

"'Mean amount of vitiated air leaving by exit pipes, three inches in diameter (twelve in number), supposing the same velocity in each, per minute, 451·6 cubic feet.

"'A passenger car of ordinary size has a capacity of about 3,500 cubic feet. According to the above results, a volume of air equal to the cubical capacity of the car enters it in about ten minutes, when running at ordinary express speed. This air, moreover is free from all dust and cinders, in fact, clean, which is not the condition of that admitted by the usual method of ventilation. There is a very noticeable difference between the quality of the air in the car ventilated by this method and the ordinary passenger car.'"

Under Water Lamps.

A new method of illuminating the tanks at the Royal Aquarium, Westminster, was lately shown by means of the "Faure" electric battery, and which, so far as it went, was of a successful character. The lights shown were, to the number of six, submerged in the tank at the foot of the west staircase with excellent effect, showing up every fish and plant with great distinctness—a result impossible to attain under the old system of gas illumination. One of the great advantages of the electric over the gas lighting system is that the fish do not seem to mind in the least the close proximity of the incandescent lamps, while at the same time they do not suffer from the noxious emanations evolved during the combustion of gas. Under Mr. Faure's system a steady light of almost any intensity can be obtained, while the engines, which can be run without cessation during the whole of the twenty-four hours of the day, effect a great saving by their power of storing the electric energy, while at the same time they obviate the danger of a sudden accidental extinction of the other light employed. The electricity used for the lighting of the tank was generated in Woolwich and carried down to the aquarium, where it arrived but a short time before it was used.

Wind Power for Electric Lighting.

In an address delivered before one of the sections of the British Association, at York, Sir W. Thomson spoke of the utility of wind power as of possible service in electric lighting. He said that cheap windmills, in connection with dynamo-electric machines and Faure's batteries, would supply a great want. A Faure cell, containing 20 kilos of lead and minium, charged, and employed to excite Swan's lamps, would give 60 candle hours—that is, an aggregate light of 60 candles for one hour, or the light of one candle during 60 hours. The charging of such a cell could be done, with good dynamo economy, in any time from six to twelve hours, or more; and the charge might be drawn off, very economically, in any time of from five hours to a week or more. As calms do not often last above three or four days at a time, Sir W. Thomson argues that a five days' storage capacity would, in general, be sufficient. One of the 20-kilo cells already mentioned, charged at any time when the windmill works for five or six hours, could be used six hours a day for five days, giving a 2-candle light. Thus 32 cells would be required to give the light of four burners of London 16-candle gas. The probable cost of dynamo machine and accumulator (which we may take at £250 in this case) would not, in Sir W. Thomson's opinion, be fatal to the plan here sketched out, if the windmill could be obtained at anything like the cost of a steam engine of equal power. Sir W. Thomson confesses, however, that windmills are very costly machines; and without inventions not yet made, could not be economically used to give power for storing up electricity in Faure cells or in any other manner.

A Portable Electric Lamp.

Recently, while the mechanical section of the British Association were discussing the means of using the electric light in coal mines, Mr. Swan, inventor of the "Swan lamp," made a remarkable statement. He produced an electric lamp of two candle power, quite detached from any wire, and portable, which could be kept lighted for six hours by a two cell Faure secondary battery. The weight of the battery would not exceed ten pounds, and to charge it afresh it would only be necessary "to place it for a time in connection with the wires of a dynamo near the pit's mouth." The battery and lamp need never leave the pit. Sir J. Hawkshaw greatly approved this lamp, and well he might. The germ of a portable and handy electric lamp, unconnected with any wire, and fed at intervals only as an oil lamp is, must lie in that rude specimen shown.

Fans in a Hospital.

A large hospital at Madras, India, is ventilated by means of a system of fans operated by steam power. The machinery is simple, the hundred fans presenting an area of 2,050 square feet, being swung by a line of steel wire about 1,700 feet in length. The fans swing together with a steady sweep of seven or eight feet, and work smoothly and silently. The long swing and uniform motion insure the desired movement and change of air without risk of draughts.

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A NEW DYNAMO-ELECTRIC MACHINE.

We give an engraving of a new continuous-current dynamo-electric machine, recently perfected by Mr. Clinton M. Ball, of Troy. N. Y. This inventor has been engaged during some years past in building machines similar in type to the alternating current machine of Hefner-Alteneck (recently described in the SCIENTIFIC AMERICAN SUPPLEMENT), especially in respect to the absence therein of solid metal parts in the armature, the latter being constituted in the form of a disk composed of a series of coils without iron cores, arranged and adapted to be moved in a magnetic field consisting of a series of poles of alternately opposite polarity on the same side of the disk, and facing opposite sides of the disk.

Mr. Ball has perfected several forms of continuous-current machines of this general type, and from among them we have selected two forms, which we illustrate. These machines have been operated with entire success at Troy; and samples of the machine are either already installed at the Paris Exhibition of Electricity, or are on their way to that destination, forming a part of the joint exhibit made by the "White House Mills" and Mr. Ball.

The bipolar machine, Fig. 1, reproduces the effects of the well-known Gramme machine, over which it possesses important advantages. Its special peculiarities and advantages may be briefly summed up as follows: The armature is composed of coils, six in number, each of which occupies a sector of the disk of 60°. These coils are made self-supporting in the disk, without iron cores or metallic parts other than the wire of which they are composed, and are connected in a continuous circuit. The commutator plates are six in number and constitute the terminals of offshoots from the junctions between two contiguous coils. These commutator plates are usually disposed spirally about the axis of the arbor of the machine so as to show at opposite ends an angular displacement from axial parallelism of 30°. From this it results that during rotation a pair of diametrically opposite coils in the amature are by-circuited during one twelfth of a revolution at the neutral point of the machine, and this effect recurs successively through the entire series of coils. It will be understood that an important advantage is gained by this arrangement, inasmuch as the resistance of the inactive coils of the armature is thereby eliminated from the internal circuit of the machine. This machine, used as a generator, presents striking and powerful effects with small expenditure of power. It may be used as a very perfect form of an electro-magnet motor. It runs without serious sparking at the commutator, and is simple and compact in construction. A further noticeable feature, which exists furthermore in all machines of this type, is the absence of any noticeable external magnetic field when running.

The other machine, Fig. 2, is a compound multipolar continuous-current machine, embodying characteristics of fundamental arrangement which distinguish it from all others; while, as before stated, in some of its theoretical aspects it resembles the machine of Hefner-Alteneck described in the article in the SUPPLEMENT.

The machine represented in the engraving, it will be noticed, has only six opposite pairs of poles in the field system. The continuous current armature system of the machine has eight elements, and the commutator twenty-four plates. The armature is otherwise composed in two sections or layers, the major section of which is utilized through a commutator or contact rings of ordinary construction for doing work upon the external circuit, while the continuous-current section maintains the magnetism of the field.

In this machine, developed and constructed long before the publication of any descriptions of Hefner-Alteneck's machine, the currents are commutated continuously, somewhat as in his machine, the commutator connections being so made that while the contact brushes remain in a fixed position, the currents are brought to them from the consequent electrical poles of the armature—the consequent points, during rotation, assuming successively different positions in relation to the field, and completing the cycle of changes during half of a revolution of the armature. During this time, furthermore, the line bisecting the armature and marking the consequent electrical points, has twice traveled over the complete circuit of the field in advance of rotation. In the case of a machine having more poles in the field than armature elements, the movement of this line would be retrograde; however, if the multiple of half the number of field poles into the number of armature elements remained the same, the number of changes would be the same in either case.

It will be seen that this machine differs from that of Hefner-Alteneck in respect to the proportion of armature elements to the number of poles of the magnetic field—the Ball machine, having a larger number of armature elements than of field poles, while his has a less number. The arrangement selected by Mr. Ball is more favorable to a simplification of details of construction without detriment to the efficiency of the machine.

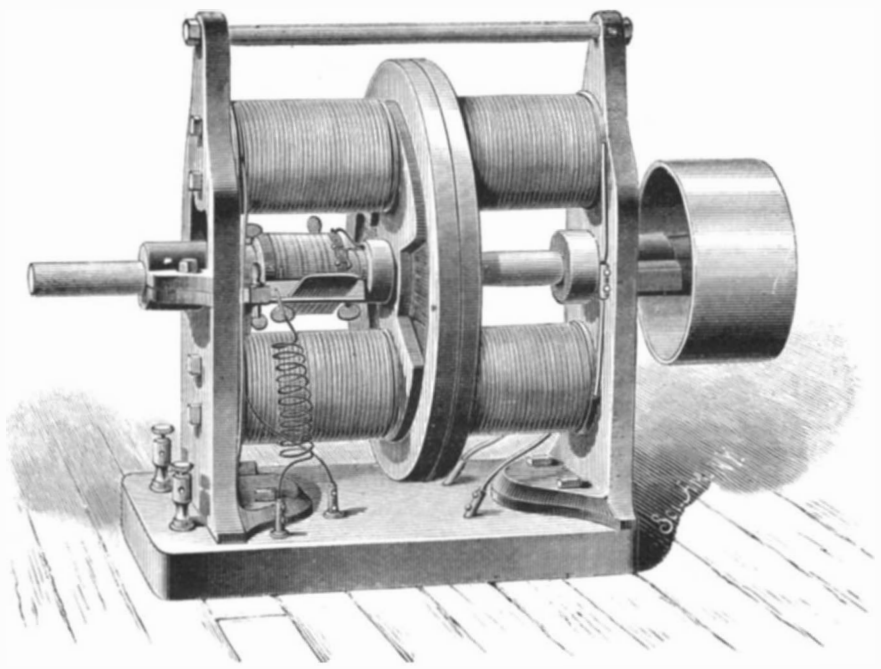

Fig. 1.—**BIPOLAR DYNAMO-ELECTRIC MACHINE.**

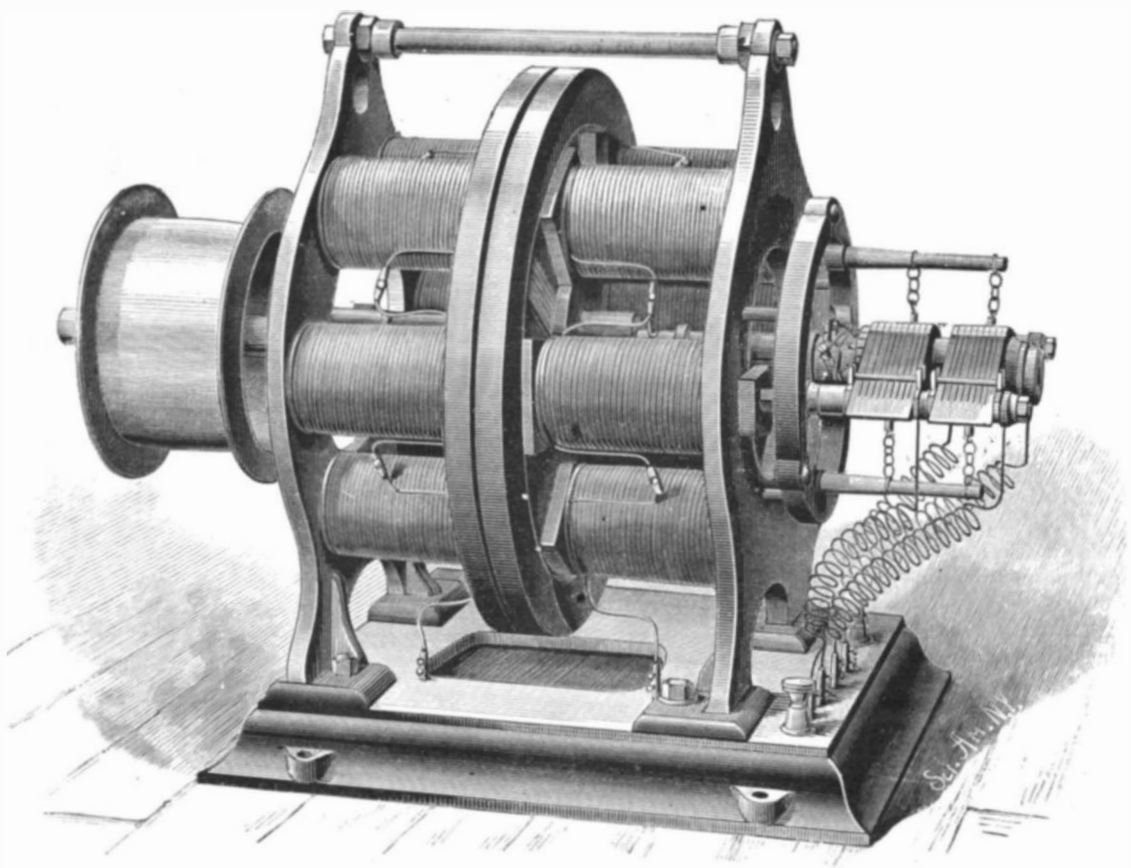

Fig. 2.—**COMPOUND MULTIPOLAR CONTINUOUS-CURRENT MACHINE.**

At a speed of rotation of 950 to 1,000 per minute, and with an expenditure of 5½ to 6 horse power, this machine has proved capable of maintaining a series of ten to twelve arc lights of good power. The machine weighs only 850 lb.

RECENT INVENTIONS.

Mr. Samuel B. Jenks, of Grand Rapids, Mich., has patented an improved electric belt for medical or therapeutical purposes. The invention consists in an electrode for an electric belt, having a sponge fastened in a cup-shaped button on the belt.

An improved adjustable notching cutter has been patented by Mr. Philander H. Elwell, of Cincinnati, O. This invention relates to an improvement on the die or cutter usually employed to form the re-entrant angles or corners in envelope blanks, and is applicable to every description of envelope, each bit being for this purpose composed of an angular piece of steel, one of whose leaves or limbs is perforated to receive a screw bolt having at its mid-length an eye that engages over another bolt, which is made square in the middle to receive a wrench.

Mr. Frank H. Carr, of Bancroft, Mich., has patented an improved device for coupling cars automatically and releasing or detaching them safely and conveniently.

An improved incubator has been patented by Mr. Joseph Colson, of Brentwood, N. Y. The object of this invention is to utilize to the best advantage the heat developed by the flame of the lamp by which the incubator is warmed.

An improved electric gas-lighting device has been patented by Mr. George J. Murdock, of Binghamton, N. Y. It consists in a sliding valve or cut-off controlling the supply of gas to the burner, which valve is attached to the armature of an induction coil contained in a casing and supported on the end of a hollow arm, through which the gas passes before reaching the burner. Wires lead from the poles of the coil to the opposite sides of the slot of the burner, and when the circuit is closed the gas valve or cut-off is opened, permitting the gas to pass to the burner, when it is ignited by the spark caused by the interruption of the circuit.

Mr. Ivan Carlier, of Hot Springs, Ark., has patented improvements in absorption ammonia ice machines for the purpose of preventing steam or vapor from being mixed with the ammonia gas which is produced in this machine, and for avoiding an undue pressure in the ammonia boiler. The invention consists in combining a smaller boiler with the main liquor ammonia boiler, these two boilers being connected by top and bottom tubes.

Mr. Fredrick E. McKinley, of Wellington, Kan., has patented an improved school desk and seat. The invention consists in combining an ink stand socket with a desk having apertures and a stationary bar that supports as well as pivots it.

An improved harness saddle has been patented by Mr. James H. Carrick, of Traer, Iowa. The yoke is widened at the lower part, and provided with flanged side edges, forming chambers for receiving side straps, in combination with the skirts, terret, screws, and nut plates, and carrying loops.

An improved folding basket has been patented by Mr. James H. Dennis, of Newark, N. J. The object of this invention is to construct baskets in such a manner that they can be folded into small space for convenience in transportation.

Messrs John Kienzy and Charles F. Davis, of Bridgeport, Conn., have patented an improved faucet which consists in a tube bent downward at the outer end, and provided at its inner end with a valve seat, on which a valve fits, attached to a screw spindle contained in a cylindrical inclined arm of the main tube.

An improvement in the treatment of furnace slag has been patented by Mr. Alexander D. Elbers, of Hoboken, N. J. This invention has for its object the rapid and cheap conversion of fluid slag and its solidification into such shapes as to materially increase its utilization. The inventor allows the fluid slag to spread swiftly in the revolving gutter, which, by preference, is made in adjustable sections and of iron or steel plates, into which it flows by a spout which is made movable so as to direct the course of the flow. The apparatus, to which the gutter is fastened, is best constructed in the form of a so-called "carrousel," which can be quickly turned, and the size of the apparatus will depend on the quantity of slag which is to be run into the gutter. After the apparatus is set in motion, the first layer of the slag, as it flows from the trough into the revolving gutter, will almost instantly become chilled by contact cooling with the bottom and sides of the gutter, while the subsequent layers have to be mainly solidified by the rapid air circulation on their surface. As the liquid slag unites or welds readily with the underlying already solidified but still very hot slag, a weld of all the layers as they accrue during rotation is to be expected.

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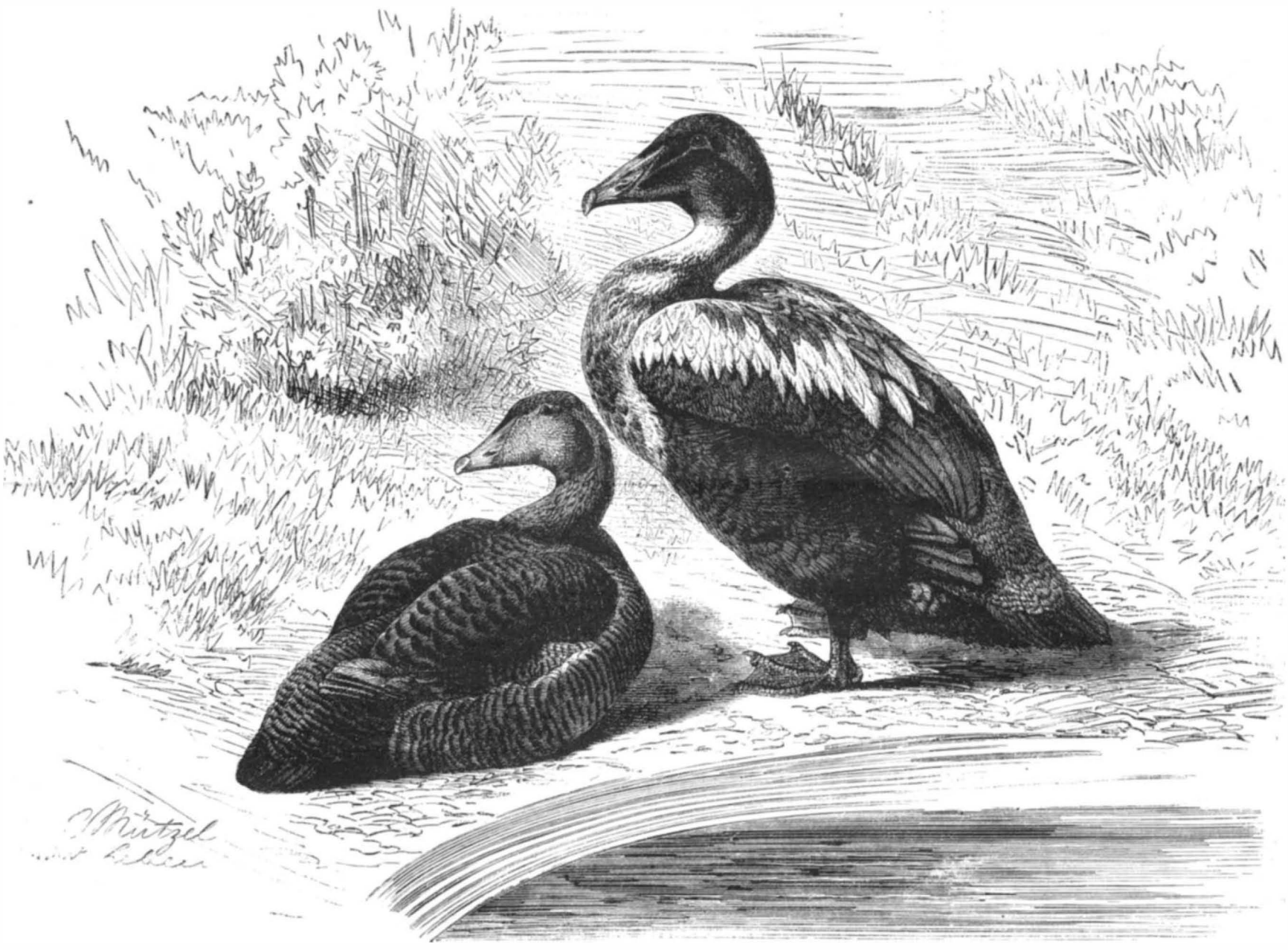
A glove buttoner, by which a glove may be buttoned without stretching or tearing the button hole or twisting off the button, has been patented by Mr. Nathaniel Pyles, of Westport, Mo. This glove buttoner is provided with a broad slotted hook having its inner portion grooved out to fit the periphery of a button, whereby the button may be rigidly held in a horizontal position while the button hole is being passed over the end of the buttoner.

An improved sound transmitter has been patented by Mr. Henry B. Porter of Chicago, Ill. This invention relates to that class of telephone transmitters in which the undulations of the electric current in the wire are controlled by the varying pressure of a conducting surface on a piece of carbon, which variations of pressure are controlled by the vibrations of a diaphragm, and which current is made through the contact faces.

THE EIDER DUCKS.

The eider duck (*Somateria mollissima*) is widely celebrated on account of the exquisitely soft and bright down which the parent plucks from its breast and lays over the eggs during the process of incubation. Taking these nests is a regular business on the northern coasts of Norway and Scotland, but is not devoid of risk on account of the precipitous localities in which the eider duck often breeds. The nest is made of fine seaweeds, and, after the mother bird has laid her complement of eggs, she covers them with the soft down, adding to the heap daily until she completely hides the eggs from view. The plan usually adopted is to remove both eggs and down, when the female lays another set of eggs and covers them with fresh down. These are again taken, and then the male is obliged to give his help by taking down from his own breast and supplying the place of that which was stolen. The down of the male bird is pale colored, and as soon as it is seen in the nests the eggs and down are left untouched in order to keep up the breed. The eider is a shy, retiring bird, placing its nest on islands and rocks projecting well into the sea. It is an admirable diver, its legs being set very far back, and obtains much of its food by gathering it under water. The bird lays from five to six eggs, of a pale green color. There are generally two broods in the year.



EIDER DUCKS.

Trichinæ in Man.

For some thirty years subsequent to the first description of the capsule by Hilton, and some twenty-five years after the identification of the parasite itself in man, the same were looked upon as mere harmless curiosities, and that, although Leidy discovered the parasite in the flesh of swine in 1847, still it was not until 1860 that the connection was established between them, appearing, as they had, in two totally different species (men and swine). The honor of this important discovery belongs to Dr. Zenker, of Dresden, Germany. The disease was discovered in a servant girl, admitted as a typhus patient to the City Hospital in Dresden. She died, and her flesh was found to be completely infested with trichinæ. Leuckart's and other experiments have shown that a temperature of 140 degrees Fahrenheit is necessary to securely render trichinæ inert. Direct heat applied to the slides holding specimens of trichinous pork, by means of the Schultz heating table, has demonstrated under the microscope that a temperature of 50 degrees centigrade (122 degrees Fahrenheit) is necessary to the certain death of the trichinæ. Leisering's experiments with trichinous pork, made up into sausage meat and cooked twenty minutes, gave positive results when fed to one rabbit and negative by another. He sums up his experiment as follows:

1. Trichinæ are killed by long continued salting of intected meat, and also by subjecting the same for twenty-four hours to the action of smoke in a heated chamber.

2. They are not killed by means of cold smoking for a period of three days, and it also appears that twenty minutes cooking freshly prepared sausage meat is sufficient to kill them in all cases.

The various kinds of cooking, however, are quite different in their effects on trichinous pork. Frying and broiling are most efficient, roasting coming next. Boiling coagulates the albumen on the outer surface, and allows the heat to penetrate less readily; it should be kept up, therefore, for at least two hours for large pieces of meat. Whether boiled, broiled, or fried, pork should always be thoroughly cooked. Practically speaking, the cooking, salting, and hot smoking which pork in its various forms receives in the United States must be, in the vast majority of cases, sufficient to kill the trichinæ and prevent infection of the person consuming the meat. Everything like those reported in Germany are unknown here, and trichiniasis in a fatal form is undoubtedly a rare disease. In the vicinity of the great pork packing establishments near Boston the "spare-ribs," containing the intercostal muscles, are very largely bought and eaten by the people near by, and trichiniasis among them has not in a single case been reported, so far as I have been able to learn. The cuts being thin and well cooked any trichinæ in them are quite certain to be killed. Even when trichinæ are introduced into the intestinal canals, too they are sometimes expelled by diarrhea, and the invasion of the system by a small number does no harm.—*American Microscopical Journal.*

M. H. TOUSSAINT (*Comptes Rendus*) finds that no contagious malady possesses a greater virulence than tuberculosis, the virus resisting and preserving its efficacy at temperatures which destroy the bacteria of splenic fever. The infection takes place as easily by ingestion as by inoculation.

Worms in Fishes.

Several communications have been received lately asking whether the small white worms infesting black bass are injurious to those who may eat the fish.

Such parasites are very common in fish, and the best authorities say that they are harmless to man; indeed Italian epicures regard certain species occurring in sea fish as a great delicacy. Of this class apparently are the white or transparent round worms which our correspondents find in the bass of the Susquehanna. They are known as *Hematodes.* Another group of fish parasites, *Cestodes*, resemble ordinary tape worms, but do not flourish in the human organism. The *Trematodes*, or flukes, and *Acanthocephalis*, two other groups of fish parasites, are too small to attract the attention of any but microscopists.

In an article on this subject in *Forest and Stream*, some months since, Mr. Frederic W. True, of the Smithsonian Institution, said that the salmon harbors at various times no less than sixteen different kinds of parasitic worms, or at least so many sorts have been discovered, and undoubtedly many others remain unknown. Four species are tape worms, and four round worms; the rest belong to the other groups above mentioned. The yellow perch has been a favorite hunting ground for the helminthologist, and he has already brought to light twenty-three species. The pike (*Esox lucius*) carries about with him at least twenty kinds. The parasites of our trout have escaped attention to a great degree, and it is credited with only one kind, but the European saibling plays host for five tape worms and three or four other worms. But one species is known to infest our shad, namely, the round worm, *Agamonema capsularia*, Diesing, although the German maifish (*Alosa vulgaris*), a close relative, carries at least seven. It must not be gathered from these facts that our fishes are more favored than those of other parts of the globe, but only that the parasites have been less carefully studied.

It was the shad worm (*Agamonema capsularia*) which caused some excitement among the fishermen in a certain part of New Jersey a few years ago, where it was found in great numbers. All anxiety was removed, however, by Dr. Leidy, of Philadelphia, the only American helminthologist whose observations have been at all extensive, who pointed out the harmless character of the animal.

The carp, lately introduced from Germany by Prof. Baird, undoubtedly brings with it some of the twelve parasitic worms which make its life unhappy in its native waters. Every new animal thus introduced in this way adds more than one name to the faunal list.

Mr. True has in his possession an undescribed tape-worm which infests the herring of the great lakes. It is not content to live in the intestines of the fish, but at a certain season in its development must needs bore into the flesh, pro-

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ducing ugly marks and quite injuring the fish for sale, much to the disgust of the fishermen. It would appear from this that these worms are interesting not only zoologically but economically. In this and some other cases it is a matter of dollars and cents.

Orange Culture in Syria.

Some very interesting notes on this subject are given in a recent consular report from Beyrout. From this we learn that the two districts in which oranges are the most plentiful are those of Jaffa and Sidon. The orange trade began to assume considerable proportions some forty years ago, when the new government of Egypt took shape, and it is now one of the most profitable industries in the two towns above mentioned. Unfortunately the inhabitants, allured by first gains, commenced planting gardens and expending money beyond their resources, the result of which has been that, in spite of all remunerations for small outlays, their improvidence has placed most of them in the power of money-lenders, who continue to advance at interest of 15 to 20 per cent. However, a company has lately been formed in Jaffa to negotiate loans with orange cultivators, and if its operations be carried on fairly we may expect an extension of horticulture, with benefit alike to the company and the borrowers. At the present moment Jaffa possesses some 340 gardens, averaging from 2,000 to 2,500 trees in each. The crop of fruit from these may be put down at about 36,000,000.

A garden costs from 40,000f. to 50,000f., and brings in 4,000f. to 5,000f. per annum. For several miles round Jaffa extends a fertile plain on which water is always to be found at a depth of 40 ft. or 50 ft. With capital and enterprise much of this might be planted, and the orange trade doubled in a short time. The present system of irrigation is that of small wells, from which the water is drawn by mules; but experiments have proved that very little engineering skill would be required in order to turn the streams of the river Andjah, some four miles from the town, over the plain. The land near Jaffa would then be cheapened in proportion as the value of that freshly watered rose. At present unplanted land close to Jaffa able to support 2,000 trees is worth 2,000f. to 3,000f.; but at two or three hours' distance it will fetch only 5f. to 6f. a deunum. The export is carried on chiefly by sailing boats for Egypt and Constantinople, and by steamers for Russia, Trieste, and Marseilles. Exportation in cases is a comparatively recent introduction, which has given considerable impulse to business with Europe. The orange gardens of Sidon are cultivated on the same principle as those of Jaffa. An acre of land at Sidon is generally valued at from 6,000f. to 7,000f., and is capable of bringing in an income of about 600f. The exportation begins in September, and is at first almost exclusively directed to Russia, till the winter closes the Black Sea ports, when it is continued to Trieste and Egypt. European cargoes are packed in paper and close cases, the rest are sent in open crates. Each case contains some 300 oranges or lemons, and last year's export is reckoned at 20,000 cases, all of which fetched very high prices, especially lemons, in Russia. The average prices are for 1,000 lemons 150 to 170 piasters; while for 1,250 oranges, reckoned as a trade 1,000, the cultivator receives 70 to 80 piasters.

Vegetation in Oil.

Some time ago Herr Von Tieghem noticed in a bottle of olive oil that was often uncorked in a room in which various kinds of mould were being cultivated several flocks of mycelia, or spawn of fungi, partly attached, partly not. He found there were two kinds, one of which could be grown on slices of potato in moist air. Returning to the subject lately, he put into olive oil fragments of stems, roots, or leaves, or whole plants, or seeds saturated with water, and submitted them to a temperature of about 25 deg. C. in an oven. In a few days the pieces were covered abundantly with mycelium vegetation, forming a continuous layer of considerable thickness. The spores which had become attached in air were thus vigorously developed in the oil. For this vegetation oil is necessary. The same species of plants inserted in water did not become covered with mycelium. In a vessel half filled with water and half with oil, and containing a piece of stem or root in both liquids, the portion in water remained sterile, while that in oil was covered largely with mycelium. On inverting the piece so that the part formerly in water was in oil, and conversely, the mycelium already developed died, and the previously sterile part grew mycelium. Mycelium flocks detached from the plants and sown in oil developed very slowly, probably because they had too little water at their disposal. No fructification was observed, and the nature of the mycelium could not be determined. These mycelia do not develop in linseed or rapeseed oil. When grown in olive oil and put in either of the others they soon die and disappear.

Some Effects of Heat and Light on Vegetation.

A curious modification of the normal structure of plant stems has been observed by M. Prillieux on making the temperature of the ground about the plant higher than that of the air above. Beans and pumpkins gave the best results. The seeds were placed in earth in a large dish, in which was inserted part of a brass rod bent at a right angle and having a gas flame applied to its horizontal end. The chamber was moist and cold. The seeds germinated well; but on coming above ground the plants acquired a peculiar shape; they grew but little in length and became unusually thick, the latter growth involving much tension in the surface layers, so that deep rifts before long appeared (mostly transverse) and made further growth impossible. M. Prillieux found the enlargement traceable mainly to an increase, not of the number, but of the volume of cells in the interior (cells of the cortical tissue and the pith). The excessive growth of these cells occurred not only in the cell wall, but in the nucleus, which was often multiplied. The excess of temperature of the ground over the air was about 10 deg. Again, the view adopted by the older botanists that light is either without effect on germination, or has an adverse effect, fails to harmonize with some results lately arrived at by Herr Stebler, in the case of many seeds of agricultural importance, such as varieties of meadow grass (*poa*), the germination of which he finds to be favored considerably more by light than by heat. Thus, with two groups of 400 seeds each of *Poa memoralis*, in one experiment, there germinated in light 62 per cent, and in darkness 3 per cent. Similarly with *Poa pratensis*—in light, 59 per cent; in darkness, 7 per cent, and so on. Sunlight being a very variable force difficult of determination, experiments were further made with gaslight, and with the same result—that light favors the germination of certain seeds, especially grasses, and that these germinate either not at all, or very scantily, in darkness. The fact was verified by Herr Stebler in quite a series of seeds, *Festuca*, *Cynosurus*, *Alopecurus*, etc. In the case of seeds that germinate quickly and easily, such as clover, beans, or peas, he thinks light is probably not advantageous.

On the Difference between Fusibility and Fusing Point.

Prof. A. Ledebur contributes to the *Metalarbeiter* an article of practical importance as well as general interest, from which we abstract the following:

The term "fusibility" is one much used in metallurgy, and generally means the temperature at which a body passes from the solid into the liquid state, and the lower this temperature the more fusible the substance is said to be. Thus ice, which melts at 0° C. (32° Fahr.) is more easily fusible than tin, which melts at 230° C. (446° Fahr.), and the latter is more fusible than lead, which melts at 325° C. (617° Fahr.). The term fusibility can also be employed in a different sense, and it seems to me that the other is more sensible and logical. Fusibility may refer to the *quantity* of heat instead of the *degree* of heat required to raise it from the ordinary temperature, or, say, from 0° C. to its melting point, and then fuse it. The smaller the quantity of heat required the more fusible the substance, because less fuel is needed to melt it. This very relation between fusibility, in the latter sense, and the consumption of fuel, which is an important factor in calculating the cost of fusion, is of such importance that I take the liberty of entering somewhat more into details.

The temperature of fusion bears no direct ratio to the consumption of fuel, for it is only necessary, when the melting point is very high, to have fuel of high pyrometric heating power (producing a higher temperature). Thus, coked or charred fuel generally gives a hotter fire than the raw fuel. Gases, which burn easily and require a smaller excess of atmospheric air than the material would that they are made of, give a still higher temperature.

The less the quantity of products of combustion, in proportion to the quantity of heat produced, the higher the temperature; hence the advantages of warming the air used (increasing the amount of heat without increasing the products of combustion), also of employing pure oxygen instead of atmospheric air (by which the products of combustion are greatly lessened by removal of the nitrogen of the air), whereby such intense temperatures are attained. The higher the temperature at which a body melts the more we are obliged to take advantage of these facts without necessarily increasing the consumption of fuel; but the more infusible it is, in the other sense of the word, the more fuel will be required to melt it.

The two different ideas of fusibility do not proceed with even step side by side, as many would at first thought suppose. To convert one kilo of ice at 0° C. into water at the same temperature, requires 79 units of heat, while only 15 units are necessary to heat a kilo of lead from 0° C. up to its melting point and fuse it. Lead, then, although it melts at 325° higher than ice is five times more fusible—that is to say, it only takes one-fifth as much fuel to melt a given quantity of lead as it does to melt an equal weight of ice.

From this it follows, that a knowledge of the quantity of heat necessary to melt the metals and their alloys—their fusibility in the narrower sense—is quite as important, both practically and theoretically, as a knowledge of the temperature at which they fuse. This quantity depends upon three factors: the specific heat, the temperature at which it melts, and the latent heat of fusion; it is $=(s\times t)+l$, in which $s=$ specific heat, $t=$melting point, and $l=$latent heat. These values are not accurately known for all the metals; specific heats vary with the temperature, and have generally been determined accurately only for temperatures below the boiling point of water; and the latent heat of but few metals is known at all.

It is, however, comparatively easy to ascertain this, and thus obtain a measure of its fusibility, by simply melting the metal and pouring it into a known quantity of water, the temperature of which was accurately measured, both before and after, with a thermometer graduated to one-fifth or one-tenth of a degree, and afterwards drying and weighing the metal which was poured into the water.

For this experiment the vessel employed is made of thin sheet copper or brass, holding a few quarts and surrounded by a poor conductor of heat (flannel or a stagnant stratum of air obtained by putting this vessel within a larger one). Within this copper vessel is a smaller one, full of holes, to receive the melted metal, so that it can be easily taken out and weighed. There is also a spatula of copper or brass for stirring after the metal is poured in. The metallic vessels and spatula are weighed, and the weight multiplied by the specific heat of copper or brass (0·095), and the product added to the weight of the water used.

The amount of heat requisite to raise the metal from 0° C. to its melting point, and fuse it, may be represented by W, and we have the formula:

$$W=s\times t_2+\frac{V(t_2-t_1)}{G}$$

in which V is the weight of the water plus the product of the weight of metal multiplied by its specific heat.

G=weight of metal.

s=specific heat of the metal below 100° C.

t=temperature of the water before the metal was poured in.

t_2=temperature of the water after pouring it in.

The most difficult point is to tell when the metal is just melted and not over heated. Pure metals may be allowed to cool until a crust begins to form, and then poured in, but for alloys this is not applicable. For those which melt below 300° C., the temperature at the time of pouring can be taken with a thermometer.

The author determined the quantity of heat necessary to melt zinc, tin, bismuth, and lead by experiment. He also calculated it from their known specific heats and latent heats. The two are shown in the following table:

	Found.	Calculated.
Zinc	62 units.	71 units.
Tin	26 "	27 "
Bismuth	18 "	22 "
Lead	14 "	16

He also examined several alloys, and found that an alloy of 90 per cent lead and 10 per cent antimony melted at 240° C., and required but 13·6 units of heat to melt it, while an alloy of tin and antimony in the same proportions melted at 236° C., yet required 28 units of heat to melt it.

It will be noticed that the quantity of heat necessary for the fusion of an alloy cannot be calculated when we know this for each constituent, any more than one can tell at what temperature an alloy will melt from a knowledge of the melting points of its constituents.

Of the simple metals lead is the easiest fusible, requiring but half as much heat to melt it as tin does, although its melting point is nearly 100° higher.

Sulphur Fumes for Cholera.

In a former issue, says the *Indian Tea Gazette*, we referred to a system of disinfection advocated by Dr. Tuson, and stated how admirably suited it was to the requirements of tea factories. A report recently published by Surgeon-Major J. W. Johnston, on cholera in the 3d Ghurkas, at Candahar, in July and August, 1879, bears out Dr. Tuson's views. The following extract from the *Englishman* on this subject, and on the question of the infectiousness of cholera, may prove of interest to our readers:

"Cholera appeared in the detachment at Abdul Rahman, and Dr. Johnston immediately applied for a supply of disinfectants. Carbolic acid was furnished, but not sulphur. On the 19th July, however, a large supply of the latter article was allowed, and a thorough process of disinfection of both accouterments and buildings was carried out that night. Among the measures adopted was the burning of two or three seers of powdered sulphur in each of the huts, tents, etc., occupied by the troops, as well as the lighting of sulphur fires outside. The village was reoccupied the following night, and, although the regiment continued to suffer, no fresh case occurred in this detachment.

"On the 23d July the same system of disinfection was carried out in the case of a detachment located at Mir Dil Khan's garden, the result being that cholera ceased at once.

"Similar results followed the use of sulphur in the 25th N. I. Cholera broke out on the 8th July and continued till the 11th August, with increasing virulence and in spite of shifting of camps. Sulphur disinfection was then carried out, and after this only one sipahi and four camp followers were attacked. The history of these cases is interesting. The sipahi had been seen on the 10th carrying some of the clothes of a man who had died of cholera. He was attacked on the 13th. The four followers were dooly bearers who had been employed in carrying cholera patients a day or two after the disinfection. On the appearance of one cholera case in G-4 Field Artillery, the same system was adopted, at Dr. Johnston's suggestion, and no other case occurred.

"The bearing of these facts on the question of the infectiousness of cholera is so obvious, that possibly men committed to the opposite theory may be tempted to under-estimate their importance. In weighing evidence of the efficacy of a remedy or a preventive, however, all preconceptions as to the etiology of a disease must be laid aside. Let those who hold that cholera is not infectious console themselves, if they please, with some new theory of the mode of action of sulphur fumes. But common sense protests against their closing their eyes to palpable facts."

RAILWAY GARDENING.—The Boston and Maine Company now allows its station agents $10 a year each with which to buy seeds, plants, etc., and offers prizes of $50, $30, and $20 to the agent whose stations are best kept and present the neatest and most attractive appearance.

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Expansion of Cement and Concrete.

Opinions of authorities differ much as to the behavior of cement in setting. An examination of extensive concrete walls, such as those of the New Victoria Docks, discloses a number of vertical cracks, which seem to indicate that a contraction of the mass has taken place. From the experiments made by Messrs. Dyckerhoff, it would appear that expansion and not contraction had taken place. In Mr. Henry Faija's little book, "Portland Cement for Users," which we lately noticed, two tables giving the results of experiments by Messrs. Dyckerhoff on a prism of cement of ten centimeters in length and five centimeters square, lying in water, are introduced. These tests show the amount of expansion in twelve varieties of cement from one week to twelve months old. Mixed with three parts of sand, the expansion is much diminished, and for architectural works, the results need not cause any serious apprehensions. Mr. Faija's remarks point to a possible contraction during the action of setting, which, however, is afterward replaced by a slight expansion.

This expansion or contraction is not so great that architects or engineers may feel any distrust of the value of cement concrete. It is, in fact, so slight that in practice, as Mr. Faija says, it may be disregarded, and we think it useful to quote the latter gentleman's observation on the experiments: "Ignoring, therefore, Messrs. Dyckerhoff's experiments (although they may have a theoretical value) in practice, when laying any large space, such as a courtyard or a length of footway with a concrete paving, it is advisable to lay it in sections, separating each by thin wooden battens. These battens may be removed in a few days, or when the concrete is thoroughly set and hard, and their space filled up with a similar concrete to that already laid; by this means there will be no danger of the appearance of the work being spoiled by the cracking of the concrete." For the walls of buildings this advice becomes of less importance, if the concrete is filled up in frames or panels, as we have more than once hinted; besides which, the occurrence at intervals of doors and windows, etc., would relieve any large surface.

Where finished surfaces have to be made, Mr. Faija deprecates the practice of putting a differently proportioned concrete as a finishing coat. It is nearly sure to crack or peel off. It is preferable to make the concrete of a finer kind, and work the face up with a trowel or float. Thus treated, the surface may be made to have the appearance of rough-cast, or a smoother finish if desired. The crushing strength of concrete seems to have been repeatedly made the subject of experiment; yet architects and engineers, in applying the ordinary weights given in tables, seem to think that the same results ought to be reached in building everywhere, whereas those tests have only reference to a small cube of an inch each way. A one-inch cube of cement will bear a great deal more than a small pillar of it twice or three times the height and of the same base.—*Building News.*

Influence of Barometric Pressure on the Discharge of Water from Springs.

BY BALDWIN LATHAM, M. INST. C.E., F.G.S., F.M.S., ETC.

The author of this paper, read before Section C (Geology), British Association meeting, York, mentioned that it was alleged, by some of the long-established millers on the chalk streams, that they were able to foretell the appearance of rainfall from a sensible increase in the volume of water flowing down the stream before the period of rainfall. He had, therefore, undertaken a series of observations to investigate the phenomena; and he found, in setting up gauges on the Bourne flow in the Caterham Valley, near Croydon, in the spring of this year (1881), and selecting periods when there was no rain to vitiate the results, that whenever there was a rapid fall in the barometer there was a corresponding increase in the volume of water flowing, and with a rise of the barometer there was a diminution in the flow. The fluctuations in the flow of the Croydon Bourne due to barometric pressure had at one period exceeded half a million gallons per day. The gaugings of deep wells also confirmed these observations; for where there was a large amount of water held by capillarity in the strata above the water line, at that period of the year when the wells became sensitive and the flow from the strata was sluggish, a fall in the barometer coincided with a rise in the water line, and under conditions of high barometric pressure the water line was lowered. Percolating gauges also gave similar evidence, for after percolation had ceased and the filter was apparently dry, a rapid fall of the barometer occurring, a small quantity of water passed from the percolating gauges. The conclusion arrived at was, that atmospheric pressure exercises a marked influence upon the escape of water from springs. The increase in the flow of the water was attributed to the expansion and escape of the gases held by the water under low barometric pressure, which cause the water to escape more freely, while with high barometric pressure there was a condensation of the gases, which led to a retardation in the flow.

Soap Bubble Balloons.

M. Delon, of Paris, produces miniature balloons by means of ordinary gas conducted through a caoutchouc tube and clay pipe to glycerine soap solution. A small disk of thin paper, with fine wire from its center to a little paper car with aeronaut figures, is connected to the bubble when it begins to swell, the disk being attached by capillarity to the part where the drop forms. The detached bubble rises with its car.

Electricity and Ballooning.

Soon after the announcement of Faure's new accumulator of electricity the idea was thrown out by Mr. Martin Tupper in this country that storage batteries could be employed with advantage in propelling balloons. Power and not levitation was, in Mr. Tupper's opinion, the true key to the attainment of aerial travel. French aeronauts have also given their attention to the subject, and at the recent meeting of the French Academy of Sciences M. Gaston Tissandier made a communication on it. The true solution of the problem, if it be feasible at all, appears to us to lie not in the exclusive use of levitation or electric power, but in a proper combination of both principles. This plan is that which M. Tissandier contemplates, and he points out that a propeller driven by electricity possesses advantages over other methods of movement. For example, it requires no fire, which is a dangerous element in a balloon inflated with hydrogen gas; it has a constant weight and gives off no products of combustion, and is readily manipulated.

M. Tissandier prepared a small balloon, pointed at the ends, 11 feet long by about 4½ feet in diameter. Its volume was 484 gallons, and when filled with pure hydrogen gas it had an ascending force of about 4½ pounds. A Trouvé motor of the Siemens type weighing nearly 8 ounces was fixed to the lower part of the balloon and connected to a double-bladed screw of 18 inches diameter. With the aid of a Planté secondary battery weighing nearly 3 pounds, the screw was driven at the rate of 6½ turns per second, and propelled the balloon through the air at a speed of over 3 feet per second during a space of 40 minutes. With two secondary elements weighing 1⅓ pounds, and a screw of 21 inches diameter, a speed of 6½ feet per second was maintained during 10 minutes. With three elements the speed was about 10 feet per second. M. Tissandier also measured the work done by the little dynamo-electric motor, and found it to be about 314 foot pounds with a single element and a speed of 5 turns per second; and with three elements it is about 7 foot pounds. He estimates that a dynamo-electric motor of 5 cwt. with 17 cwt. of secondary batteries will yield 6 horse power of work. This weight could be raised by a hydrogen charged balloon of 3,900 cubic yards volume, and similar to that employed in 1852 by M. Giffard, and in 1872 by M. Dupuy de Lôme. It would be 131 feet long by 43 feet in diameter at the middle, and its ascending force would be about 3½ tons. With all its appurtenances it would weigh from 19 cwt. to 22 cwt., and there would remain from 1 ton to 2 tons for ballast and voyagers. In calm weather it would have a speed of from 12 to 15 miles per hour, and it would be able to deviate from the line of a wind.

It is true that this result could only be obtained during a limited time, but the conditions would be greatly improved by lighter batteries and possibly by the use of M. Faure's accumulators. While upon this subject we may also mention that M. Trouvé has tried his electrically propelled boat on the upper lake of the Bois de Boulogne with a Trouvé motor and a four-bladed screw about a foot in diameter. Twelve Bunsen cells of Ruhmkorff's pattern propelled the boat, containing three persons, at a speed of 10 feet per second, but this rate fell off at the end of three hours to about 9 feet per second, and at the end of five hours to 8 feet per second.—*Engineering.*

Improvement in the Manufacture of Parabolic Mirrors.

A very ingenious method of manufacturing parabolic reflecting surfaces has been invented by M. Latchinoff, who has described the process fully, says *Engineering*, in our Russian contemporary, *L'Electricité.* It is based on the fact that all points of the free surface of a liquid turning round a vertical axis acquire a constant angular velocity and take a parabolic form. If, then, the liquid is put into a vessel which is rotated round a vertical axis it will form a hollow shell of parabolic section inside, and if the liquid is one which will solidify a rigid paraboloid will be obtained capable of being used as a reflector. M. Latchinoff, therefore, mounts a hemispherical vessel upon a vertical shaft carrying a pulley, and rotates it by an endless belt from a motor. Into this he pours a sufficient quantity of plaster of paris liquid or a solution of the mastic prepared by M. Mendelejeff. Fusible metals would serve the purpose, too, but they are apt to oxidize on the surface, and in cooling they tend to crystallize. The shape of the vessel need not necessarily be a hemisphere, but this form is convenient; and a glass cover should be added to it.

To regulate the thickness of the liquid shell a ring of wood is fixed within the bowl at a proper distance below the edge. This prevents the liquid rising above a certain height. Regularity of motion is most essential to the success of the operation, and hence a steam engine is not adapted to drive it; but a small Gramme or Siemens dynamo-electric machine actuated by a Thomson or a Tchikoleff battery will answer well. Three or four cells will suffice, and the speed can be regulated by resistance placed in circuit. With a Deprez or Helmholtz regulator any kind of battery may be used. An angular speed of a turn per second is quite sufficient for the purpose; and the axis ought to be verticalized by means of a spirit level, and fixed so as to be free from shake or jar. The liquid should be one which solidifies slowly, say in an hour, and without shrinking much in bulk. The shells thus prepared can be made reflective by electrotyping with nickel, silver, or iron, which, when prepared in this way, oxidizes with difficulty, and being almost white will serve for a reflector if kept under glass.

The Chanoine Dam at Pittsburg.

Work upon this great undertaking—which has been described fully in these columns—is progressing with unusual rapidity, owing to the remarkably low stage of water in the Ohio River. The most difficult and hazardous portion of the work is now being vigorously prosecuted, namely, the digging for the foundations of the sill of the dam. This requires an excavation 556 feet long and 15 feet below the bed of the stream, and, of course, directly across the channel. To render this work possible an enormous coffer dam, 614 feet by 230 feet, was successfully constructed.

To fill the double walls of this coffer with clay an ingenious arrangement was devised by Superintendent Meredith. A line of 4-inch pipe, 1,800 feet long, led from a powerful centrifugal pump to the coffer. The pump was supplied with water and clay in proper proportions and delivered a 4-inch stream of mud into the coffer walls. The water draining off left the clay a compact, watertight mass just where it was wanted. The necessity for haste in the present stage of this work can be understood when it is stated that the coffer dam virtually blockades the Ohio, and that nearly every town and city along the Ohio and the Mississippi from Pittsburg to New Orleans, and including St. Louis, depends wholly or in part upon the river shipments of coal from Pittsburg. Until the coffer dam is removed the only passage way for steamers is between the completed lock walls of the dam, a space only 110 feet wide.

There are at present 10,000,000 bushels of coal loaded in barges, etc., at Pittsburg, and awaiting a favorable stage of water to start down the Ohio. To move this requires a fleet of 70 steamers and nearly 200 barges, and it is an open question whether even a small proportion can get through the lock wall space before the erratic river recedes again. Lieutenant W. M. Black, the United States officer in charge, is, however, pushing things rapidly, and by the use of the electric light doubles the working hours of the force of laborers employed, promising to raise the blockade by November 15.

Influence of Lime on Soils.

Professor E. W. Hilgard, in discussing the "Objects and Interpretation of Soil Analyses," gives, among other things, the following advantages resulting from an adequate supply of lime in soils:

1. A more rapid transformation of vegetable matter into active humus, which manifests itself by a dark or deep black tint of the soil.

2. The retention of such humus, against the oxidizing influences of hot climates; witness the high humus percentages of such soils, as against all others, in the Southern States.

3. Whether through the medium of this humus, or in a more direct manner, it renders adequate for profitable culture percentages of phosphoric acid and potash so small that in the case of deficiency or absence of lime the soil is practically sterile.

4. It tends to secure the proper maintenance of the conditions of nitrification, whereby the inert nitrogen of the soil is rendered available.

5. It exerts a most important physical action on the flocculation, and therefore on the tillability of the soil, as heretofore shown by Schloesing and by myself.

Professor Hilgard adds that in the majority of soils (excepting those that are extremely sandy) the lime percentage is greater in the subsoil than in the surface soil. This is doubtless, he explains, the result of the easy solubility of calcic carbonate in the soil water, which carries it downward and thus tends to deplete the surface soil. This fact is strikingly shown in the results of Loughridge's investigation on the composition of the several sediments. The efficacy of lime in preventing "running to weed" in fresh soils, and in flavoring the production of fruit, is conspicuously shown in a number of cases.

Magnets.

M. Trouvé finds that if three steel bars of the same length and size are magnetized, then demagnetized, and afterwards remagnetized, the magnetic power due to the first magnetization being represented by 2, 3, 4, the power of the second will be 4, 9, 16. He found it necessary to demagnetize very regularly. To mangetize the bars he placed them in two solenoids in juxtaposition, closed the magnetic circuit by means of two soft iron plates, and caused a current to pass from a battery of six Wollaston cells. He thus obtained magnets of great constancy. He states that straight magnets support twelve or fourteen times their weight; if the magnet be of horseshoe form it will support forty-eight or fifty-six times its own weight.

Expectancy of Life.

Insurance companies are aware of the credulous weakness of those whose lives they assure, and have therefore compiled numerous tables of expectany of life for their own guidance, which are carefully referred to before a policy is granted. These tables have been the result of careful calculation, and seldom prove misleading. Of course, sudden and premature deaths, as well as lives unusually extended, occasionally occur; but the average expectancy of life of an ordinary man or woman is as follows: A person 1 year old may expect to live 39 years longer; of 10 years, 51; of 20 years, 41; 30 years, 34; of 40 years, 28; of 50 years, 21; of 60 years, 14; of 70 years, 9; of 80 years, 4.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Dr. Scott's Electric Hair Brush has given universal satisfaction whenever used. It is beautifully made, and is well worth the price as a brush without considering its electric qualities. Over 7,000 testimonials from prominent citizens can be seen at the New York Office, 842 Broadway.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 236.

61 Musical Bells. Box 471, Hyde Park, Mass.

For Sale.—One new Peck Lifter and Drop complete. Inquire of Bradley & Co., Syracuse, N. Y.

For Sale.—SCIENTIFIC AMERICAN from March 29, 1873, to July, 1881. Address P. K., 153 Shawmut Ave., Boston, Mass.

Magic Lanters and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

New Comb'd Milling and Gear Cutting Machines, large range. C. A. Condé & Co., Makers, Philadelphia, Pa.

Printing Presses with my Patented Card Drop print much quicker. ($7½ to $403.) Type, ink, cards, etc. Circulars free. Louis Frik, 244 Race St., Philadelphia.

A valuable article on the Treatment of Acute Rheumatism, by Alfred Stillé, M.D., will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 299. Anything from the pen of this eminent and experienced physician is interesting and instructive.

New Method of Graining, etc. J. J. Callow, Cleveland, O.

Inventor's Institute, Cooper Union, New York City. Permanent free exhibition of new machines, inventions, and patents. See advertisement page 252.

Foot Lathes, Fret Saws, 6c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Improved Skinner Portable Engines. Erie, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Peck's Patent Drop Press. See adv., page 204.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N. Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 204.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

Saw Mill Machinery. Stearns Mfg. Co. See p. 205.

Supplee Steam Engine. See adv. p. 204.

For Pat. Safety Elevators, Hoisting Engines. Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 221.

Safety Boilers. See Harrison Boiler Works adv., p. 222.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 221.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 238.

Paragon School Desk Extension Slides. See adv. p. 237.

Brass & Copper in sheets, wire & blanks. See ad. p. 236.

The Twin Rotary Pump. See adv., p. 206.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Wren's Patent Grate Bar. See adv. page 237.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Berryman Feed Water Heater. See illus. adv., p. 237.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser M'f'g Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 236.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 238.

New Economizer Portable Engine. See illus. adv. p. 236.

Sewing Machines and Gun Machinery in Variety. The Pratt & Whitney Co., Hartford, Conn.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 238.

The Sweetland Chuck. See illus. adv., p. 238.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N. J.

Skinner's Chuck. Universal, and Eccentric. See p. 238

For Machinists' Tools, see Whitcomb's adv., p. 238

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) L. J. K. asks whether it would make any appreciable difference in the strength of an electro-magnet to inclose the coils in brass similar to the usual rubber covers. A. In a magnet of high resistance it would make a difference.

(2) A. A. B. writes: Please give the weight of the largest gun ever cast, also the size of shot and quantity of powder required? A. Several Armstrong 100-ton guns have been made: caliber 17·72 inches; total length 32·65 feet; length of bore 30¼ feet; powder chamber 60·12 inches long by 19·7 inches diameter; powder charge, 551 pounds; weight of projectile (battery shell) 2,500 pounds; muzzle velocity 1,725 feet a second; total energy 41,333 foot pounds. A Woolwich gun of 160 tons has been projected. We have not heard of its completion.

(3) H. D. asks: 1. What is the meaning of resistance in speaking of wire? A. Electrical conductors of different sizes and different lengths offer a greater or less impediment to the free passage of electricity according as they are small or large, long or short, and it is assumed that the different conductors have a specific power of resisting the passage of the current. This is called resistance. 2. Why do they use thinner wire on long circuits both on line and coils? A. Experience has demonstrated that to obtain the full effects of the current on a given circuit, the helix in which the work is done must, in the matter of resistance, equal the line and battery. 3. I would like to know why telephone companies use such thin wire on main lines. A. Because the secondary current is employed, which does not require a heavy conductor. 4. Could not a piece of carbon be substituted for the convex platinum button in the Blake telephonic transmitter, as is done in the transmitter described in SCIENTIFIC AMERICAN, of March 19, 1881? A. Not with good results. 5. Which one do you think would be the easiest and most inexpensive one to make to be used with a bell telephone? Can a Hughes microphone be used on a short line in connection with a bell telephone? A. Use the Blake transmitter.

(4) W. K. F. asks: 1. What kind of saw band, mulay, sash, circle, or any kind of saw, requires the least power to saw a given amount of lumber? A. We recommend a circular saw mill, as being more simple and effective than either of the others. 2. What is the horse power required to saw on average 1,200 feet hard wood lumber per day (ten hours)? A. An 8 horse power engine would saw 1,200 feet in ten hours; but we recommend you to have not less than 10 horse power.

(5) L. D. D., Jr., asks (1) how to polish horn. A. Dress down with powdered pumice stone, two sizes (the finest last), and water. This may be applied on a wheel—horizontal or buff. Finish with whiting, or, for fine work, putty powder. 2. Is rain water the softest of all water (excepting distilled)? A. Yes.

(6) D. F. writes: I have a new kitchen floor which I wish to wax. Can you inform me how to make the wax? A. Two oz. of pearlash, 10 oz. of wax, and about half a pint of water are heated to boiling in a dish, which is frequently agitated, until a thick fluid mass is formed, from which, upon removal from the fire, no watery liquid separates. Boiling water is now cautiously added to the mass, until no watery drops are distinguishable. The dish is again set on the fire, but its contents are not allowed to boil (otherwise myricin would separate out), 8 or 9 pints of water being added, little by little, with constant stirring. Coloring matter may be added if desired.

(7) E. E. H.—The following methods of tempering mill picks have proved very successful: 1. Take 2 gallons rain water, 1 oz. of corrosive sublimate, 1 of salammoniac, 1 of saltpeter, 1½ pints rock salt. The picks should be heated to a cherry red and cooled in the bath. The salt gives hardness, and the other ingredients toughness to the steel; and they will not break if they are left without drawing the temper. 2. After working the steel carefully, prepare a bath of lead heated to the boiling point, which will be indicated by a slight agitation of the surface. In it place the end of the pick to the depth of 1½ inches until heated to the temperature of the lead, then plunge immediately in clear cold water. The temper will be just right if the bath is at the temperature required. The principal requisites in making mill picks are: First, get good steel. Second, work it at a low heat; most blacksmiths injure steel by over heating. Third, heat for tempering without direct exposure to the fire. The lead bath acts merely as protection against the heat, which is almost always too great to temper well.

(8) O. R. M. writes: I am much annoyed with dandruff. Can you suggest a harmless and reliable remedy? A. Dandruff (*Pityriasis*) is a chronic inflammation of the skin, characterized by the production of minute white scales or scurf in excessive quantity. The affection is often very rebellious to treatment. Various preparations are sold which are claimed to be beneficial, and physicians sometimes prescribe tonic infusions, purgatives, and the application of sedative lotions. In obstinate cases an internal dose in which arsenic is the essential element is sometimes prescribed. The efficacy and safety of such measures are to be doubted. Probably the best plan is to keep the hair short and shampoo it frequently with a solution of borax in warm water, avoiding rough treatment, which has a tendency to increase the irritation.

(9) A. E. S. asks how to lay off a safety valve lever and place the weight so that the valve will blow off at a given pressure. A. Multiply the weight of the lever by the horizontal distance of its center of gravity from the fulcrum; the weight of the valve by its horizontal distance from the fulcrum; the area of the valve by the steam pressure and horizontal distance of the valve from the fulcrum. Add together the first two products, subtract their sum from the third product, and divide the difference by the weight of the ball.

(10) S. asks: How can I ebonize wood, and what kinds of wood are best adapted to this finish? A. Apple, pear, and walnut, if fine grained, may be ebonized by the following process: Boil in a glazed or enameled iron vessel with water, 4 oz. of ground gallnuts, 1 oz. of logwood chips, and ½ oz. each of green vitriol and crystals of verdigris. Filter while warm, and brush the wood over with this repeatedly. Dry and brush over with strong cold solution of acetate of iron and dry. Repeat this several times, and finally dry in an oven at a moderate temperature, and oil or varnish.

(11) E. G. T. asks: 1. Will not a wheel of one pound weight, revolving 100 times per second, be of the same value as a balance wheel as one weighing ten lb., revolving ten times per second? A. The regulating power of a fly wheel is as the weight into the square of the velocity. Hence supposing that in your two cases, the weight travels on the same radius, it will be as weight into the square of the revolutions, or 10,000 in first case and 1,000 in second case. 2. I have two magnets placed together so that their opposite poles correspond. They attract each other with a certain force. Now, if the poles of one of the magnets be reversed, will the magnets repel with the same force as they attracted before? A. The two forces are not the same, the repulsion being the smaller force. 3. I have some copper wire with which I wish to make an electromagnet. In which way will I get the most power, to wind all the wire on one magnet or to have two one half the wire on each? The current is to pass through the whole length of wire in either. A. The greatest force can be obtained from the single magnet under the conditions given.

(12) J. N. W. asks: What ingredients and quantities of each for pattern varnish? A. For pattern varnish cut 4 oz. of orange shellac in 1 pint of alcohol. If black varnish is desired add fine lampblack.

(13) C. L. W. asks: Will a mercurial barometer work as well in a room as it would out of doors? A. Yes.

(14) A. W. H. L. writes: We have recently moved in a house that is overrun with bed bugs and roaches, also ants. My wife has tried everything we have heard of, even wetting the cracks of the flooring with sulphuric acid, but it seems to have no effect on them. They are not in the furniture, as it is all new. A. Try oil of turpentine. It may be introduced into the cracks and crevices infested with the insects by means of a sewing machine oil can. A very small quantity of the liquid, if judiciously used, will suffice.

(15) J. J. asks: Can you tell me of some preparation to clean and polish brass that is exposed to heat, such as brass on a locomotive both in cab and outside? A. Clean the work with emery flour and a little refined paraffine oil; wipe and finish with cotton waste and a trace of oil.

(16) T. Q. asks how to make printer's rollers. I have made a few of them here, but they don't seem to have the proper amount of suction to make work look as nice as I have been accustomed to do in New York city. A. Best white glue, 1 lb.; concentrated glycerine, 1 lb. Soak the glue over night in just enough cold soft water to cover it. Put the softened glue in a fine cloth bag, gently press out excess of water, and melt the glue by heating it over a salt water bath. Then gradually stir in the glycerine and continue the heating, with occasional stirring, for several hours, or until as much of the water is expelled as possible. Cast in oiled brass moulds, and give the composition plenty of time to cool and harden properly before removing from the mould and inking. See that the ink is well spread before bringing the roller in contact with type. 2. Please let me know if the water used in heating the composition should be kept boiling? A. The water in the water bath should be kept boiling.

(17) R. H. B. asks: 1. Do all dynamo-electric machines require to be first charged with an electric battery before they will generate a current? A. No; the magnetism naturally residing in the iron of the field magnet is sufficient to start the current. 2. How is the candle power determined of any electric lamp or machine? A. By comparison with a standard candle in some sort of a photometer. 3. What work can be had that will give the desired information regarding ohms, volts, webers, ergten, or ergio, etc? I am making it a special study as far as I can. Have several good works, and keep getting SUPPLEMENTS, which, I think, will help me along, but have not got the right thing yet. A. Ganot's Physics and Prescott's Electricity are good works. 4. Is there any published work on electric motors? Can you send SUPPLEMENTS with illustrated articles on same? A. We know of no work especially devoted to electric motors. The SUPPLEMENT contains many articles on the subject. 5. I took an ordinary U magnet to a painter to have it repainted (red); he painted it, but, as it did not dry, he set it in the sun, but after about twenty trials, he said, by himself and other good painters (considered so), he gave it up as a bad job, and gave it to me still very sticky. What was the trouble? What is it magnet makers produce that bright, fine red with? A. The red varnish is made by mixing English or Chinese vermilion with alcoholic shellac varnish. 6. Is it not possible to see electricity? Is not the spark considered and calculated to be the electricity itself? A. Electricity is known only by its effects. The spark is one of them.

(18) N. P. H. asks: Which is best to use in a cylinder, a good oil or tallow? Will tallow or any animal grease injure the inside of a cylinder? A. Use good oil. Tallow as generally supplied to the market, contains an acid which attacks the metal.

(19) H. E. B. asks: How fast can an engine with 10 inch cylinder, 30 inches stroke, 60 lb. steam, be run with safety to run a circular saw 700 revolutions per minute; and what size of pulley on saw arbor would it require, pulley on engine being 96 inches in diameter and belt running direct? A. If well balanced and adjusted, 100 revolutions per minute. Diameter of pulley 13½ inches nearly.

(20) W. W. C. writes: 1. This town wishes to put in a system of water works. We can procure 99½ feet head. The spring is very large and distant some two miles. If we start with a large main, say 8 inch, and at one-half the distance reduce it one-half, will not the force be greater, and the hydrants throw a higher stream? A. No. 2. What height of stream can we procure here from mouth of hydrant with a conical hose on nozzle? A. Much depends upon size, length, and course of pipes, but probably 68 to 76 feet. You are mistaken about the effect of reducing the main; it would be injurious rather than beneficial.

(21) T. K. asks: What quantity of cork would be required to sustain a man of average weight in the water? A. The steamboat law requires 6 lb. good block cork for life preservers.

(22) A. S. L. asks for the cheapest and best possible way of constructing, and the cost of, a reservoir with a capacity of 30,000 gallons of water. A. This will require a reservoir 16 feet square and 16 feet deep. Cost depends on nature of soil and position. Any good mason will advise you.

(23) J. A. asks if it is usual to give lead to the valves of express passenger engines, and if so, how much. Also the lead necessary for freight engines. A. Steam lead is generally one-eighth of an inch to three-sixteenths of an inch. All engines should have lead.

(24) J. N. H. writes: I have a cupola, 24 inches in diameter, with two tuyeres 5 inches in diameter. Would anything be gained if the tuyeres were set by one another, so as to give a spiral direction to the blast? A. We do not think the advantage would be appreciable except with a weak blast.

(25) F. W. H. asks what the meaning of the word "pitch" is in speaking of a propeller screw. A. The advance which would be made by the angle of the blade if turning in a solid.

(26) A. B. S. writes: In the SCIENTIFIC AMERICAN, No. 12, September 17, page 186, in answer to (5) J. A.'s inquiry, you told how to make tin look like crystals or like frost on windows in winter. May I ask if the same may be done on silver, and by what method? A. No; silver has not the peculiar crystalline structure of tin. Frosting is sometimes done by a revolving tool in a lathe. 2. How is the water and fire proof paint that we see on the cottages made? A. See Water-glass, page 16, No. 2, current volume.

(27) C. F. K. asks for some varnish, paint, or enameling process for covering a plate iron tank to protect it from the joint action of grease, alkali, and water. Or, again, what is the best mode of preventing corrosion under such circumstances? A. We know of no satisfactory coating that could be applied to the iron. The tank might be lined with thin sheet lead.

(28) C. S. G. writes: 1. I would like any information you can give in regard to nickel plating. I have a bicycle I would like to plate. A. Use ammonia nickel sulphate, three quarters of a pound to the gallon of soft water, for the plating bath. Cleanse the wire with hot potash and cyanide solutions and pumice stone, as directed in article on nickel plating, page 153, vol. xliii., and having connected it with the zinc pole of the battery, draw it slowly through the plating bath between nickel anodes (connected with the copper or carbon pole of the battery), and under rubber pulleys so arranged as to keep it immersed in the liquid. For details respecting the management of such baths see the article referred to. 2. Is there such a thing as waterproof glue? A. You will find good receipts for waterproof glue under Cements, page 2510, SUPPLEMENT, No. 158.

(29) J. N. M. asks: Is not a good injector more economical than a good pump, for a factory engine of uniform speed? In this particular instance the injector would be non-lifting. A. Under the conditions you name there is very little difference in economy between an injector and a pump with a good heater. But the injector has the advantage that you can feed the boiler when the engine is not running.

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(30) J. L. L. writes: I have an item here which I think is worth space in your columns. I refer to a heat I took off in the Manhattan Foundry yesterday. It was a small heat of 6,000 pounds, which was taken off in one hour and twenty minutes, and was melted with 600 pounds of coke, which you will see was ten to one, and which is the best I have ever done or ever heard of being done, and I have worked at the business now almost seventeen years with good success. Our engine is a small donkey, which runs at 75 revolutions, while the fan runs 3,000 per minute. The fan is a No. 6 Sturtevant, and the furnace is only a 30 inch, with two tuyeres 2½ by 7 inches, and our iron is all old scrap, and some of it has been melted a great many times. The amount of castings obtained from the heat was 5,526½ pounds, which, I think, taking all into consideration, is worth notice. A. This is an excellent result, far above the average. But we have known (on a test) 13 pounds iron brought down to one pound anthracite coal. If coke had been mixed with the coal, or coke only used, a still better result could have been obtained. But this was from a cupola about 42 inches diameter.

(31) E. J. R. asks: What is pepsin, and how is it prepared? A. Pepsin is a nitrogenous substance existing in the gastric juice, and as a viscid matter in the peptic gland and on the walls of the stomachs of animals. The mucous membrane of the stomach (of the hog, sheep, or calf, killed fasting) is scraped, and macerated in cold water for twelve hours; the pepsin in the strained liquid is then precipitated by acetate of lead, the deposit washed once or twice by decantation, sulphureted hydrogen passed through the mixture of the deposit with a litttle water to remove the whole of the lead, and the filtered liquid evaporated to dryness at a temperature not exceeding 105° Fah. As met with in pharmacy the strength of pepsin varies greatly. It is often prepared by simply mixing with starch the thick liquid obtained on macerating the scraped stomach with water, and evaporating to dryness. The composition of pepsin is not positively known.

(32) J. M. asks how to proceed to ascertain the average rainfall. A. Take a quart bottle of uniform diameter, and graduate its liquid contents by a scale of tenths of an inch accurately engraved on the side; fit into the neck of the bottle a 40° funnel, the diameter (in inches) at the rim or widest part of which has been accurately ascertained; then diameter square ×0·7854= area in inches of the base of the inverted cone. Suspend the rain gauge in an upright and exposed position. Then, number of inches of rain collected in the bottle ÷time of exposure=average rainfall in inches. The gauge should of course be out of the reach of spattering water from surrounding objects, and in order to avoid great error through the spattering of the water from the funnel, the angle of the sides of the latter should not be greater than 40°. The neck of the funnel should be narrow, and due allowance must be made for evaporation. Readings should be taken if possible before as well as after a rainfall. The indications of this simple instrument are sufficiently accurate for all ordinary purposes.

(33) E. D. asks how to discover lead poison in water. A. Evaporate by gentle heat a small sample of the water nearly to dryness in a clean porcelain cup, moisten the residue with acetic acid, and add to a portion of it a few drops of strong hydrosulphuric acid—pure water saturated with the gas evolved by the action of dilute sulphuric acid on iron mono-sulphide; a black precipitate indicates lead. Add to another portion of the dilute acetic acid solution a little pure hydrochloric acid; a white precipitate, which redissolves on diluting with boiling water indicates lead. To the remainder of the solution add a few drops of dilute sulphuric acid, and let it stand for a time; a white heavy precipitate indicates lead.

(34) W. M. C. asks: Which will afford most power or do the most grinding, a twenty foot overshot wheel, or one twelve feet (overshot), if the same water be used on each per hour of running time? If any difference, state what. A. With the same quantity of water and same velocity, the power of the two wheels will be nearly directly in proportion to their diameter.

(35) H. S. writes: In your issue of the SCIENTIFIC AMERICAN, No. 6, vol. xlv., August 6, in your description of the sea lamprey, you state that it was and is now used for food. Will you please state in your paper what part of the lamprey issued for food and how it is dressed? A. The only part of the lamprey not used is the head. Lampreys are cooked in the same styles as the common eel, namely, fried, stewed, potted, deviled, and chowdered with potatoes and fat pork. A large part of the famous London eel pies are composed of the lamprey eel, and the substitute is considered by judges as a great improvement over that of the common eel. Lamprey eels cannot be smoked, as they contain so small a quantity of fatty material, but are excellent when pickled in salt or vinegar.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

D. G.—No. 1. The powder consists chiefly of oxide and sulphide of iron. The latter probably carries a little silver and gold—it would require an assay to determine this. No. 2. Quartzose rock containing basic sulphides of copper and iron carbonate and silicate of copper and lead sulphide, (galena). Would probably assay high in silver. No. 3. Quartz with sulphides of iron, copper, and zinc—probably carries both gold and silver. No. 4. Silver-bearing quartz.—E. S. M.—Bituminous coal.—A. A. W.—It is ammonium nitrate.—S. G. S.—Fine white siliciouss and—used in the manufacture of glass and pottery, soluble glass, cements, and enamels, and for scouring purposes.—H. B. M.—A fragment of sandstone.—D. W.—Iron pyrites—iron sulphide.—J. B. S.—Ferruginous micaceous quartz rock containing a little hornblende.—W. H. B.—Partially decomposed feldspathic rock—of little value.—R. E. P.—An argillaceous limestone—might make a good cement.—B. G. U.—1. Red jasper. 2 and 3. Flint.—4. Lime carbonate. 5 and 7. Limonite—oxide of iron. 6. Limestone.

COMMUNICATIONS RECEIVED.

On the Electrical Theory of Comets, by C. S. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 13, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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CAUTION.—*An attempt has been made to put so-called "Electro Magnetic" Brushes upon the market, but the Post-Office authorities at Washington have published the company as a fraud. We therefore caution the Public to be careful that "Dr. Scott's" name is on the box and "Electric" on the Brush. Ours is not wire, but a pure bristle Brush.*

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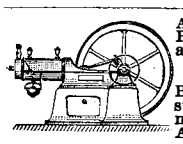

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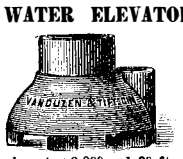

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Patent No. 61,543, issued January 29, 1867, relates to sharp-edged fertilizer feed slides, with attachments.

Patent No. 61,544, issued January 29, 1867, relates to axles, gear wheels and shields, etc. (subject to State rights of Henry Kuhlman to manufacture in Illinois and Missouri).

No. 61,545, issued January 29, 1867, relates to fulcrum placed between boot and spring hoe; also, vibrating seats, etc.

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No. 104,854, issued June 28, 1870, relates to double acting reversible movement of fertilizer feeder.

No. 105,810, issued July 26, 1870, relates to slide block for adjusting the angle of spring hoes.

No. 105,811, issued July 26, 1870, relates to double rotary fertilizer sower.

No. 137,929, issued April 15, 1873. A peculiar arrangement of locking bars or hoe shifting.

No. 150,328, issued April 28, 1874, relates to improved slide blocks, with attachments.

No. 153,345, issued July 21, 1875, and reissued as No. 8,343 and No. 8,344.

No. 8,343 relates to throwing axle rail out of way of hoes.

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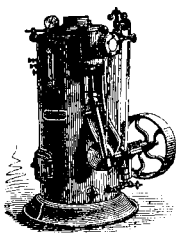

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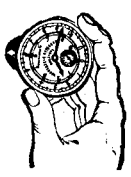

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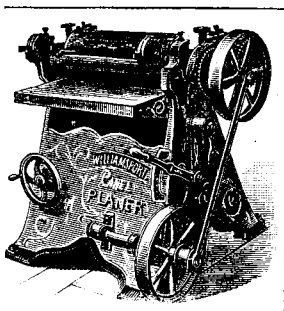

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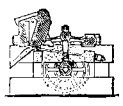

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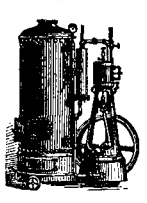

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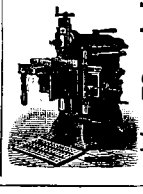

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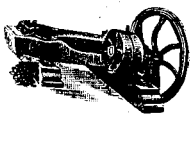

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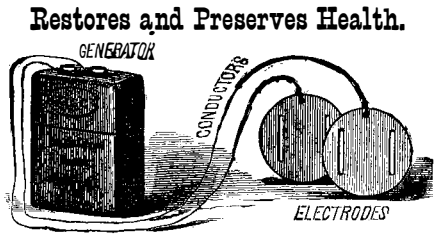

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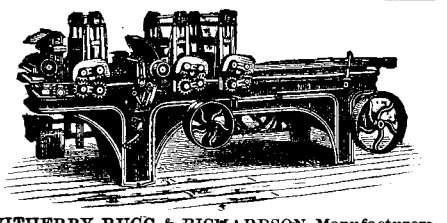

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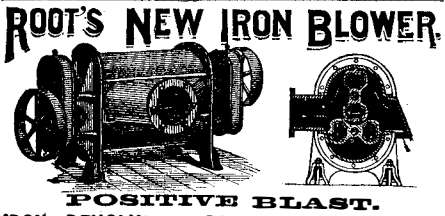

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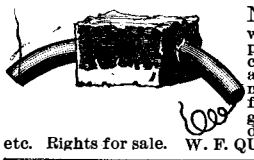

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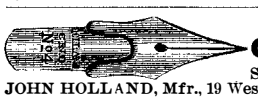

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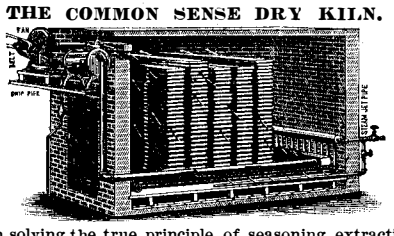

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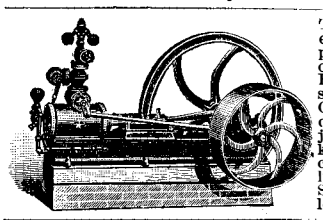

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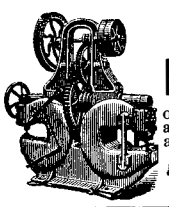

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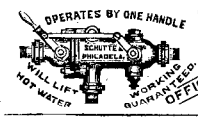

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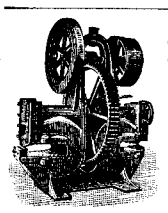

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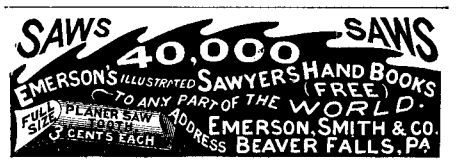

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